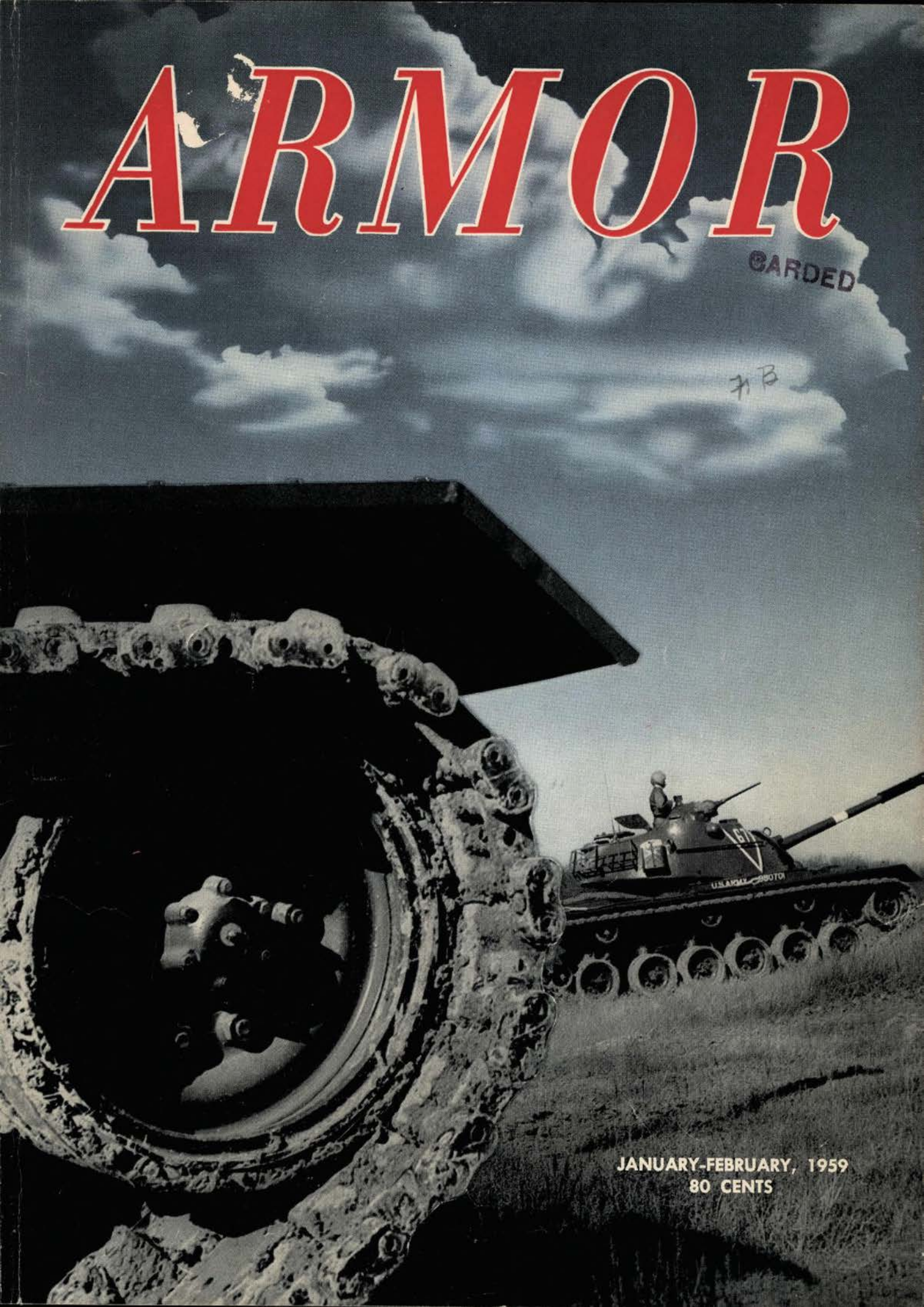
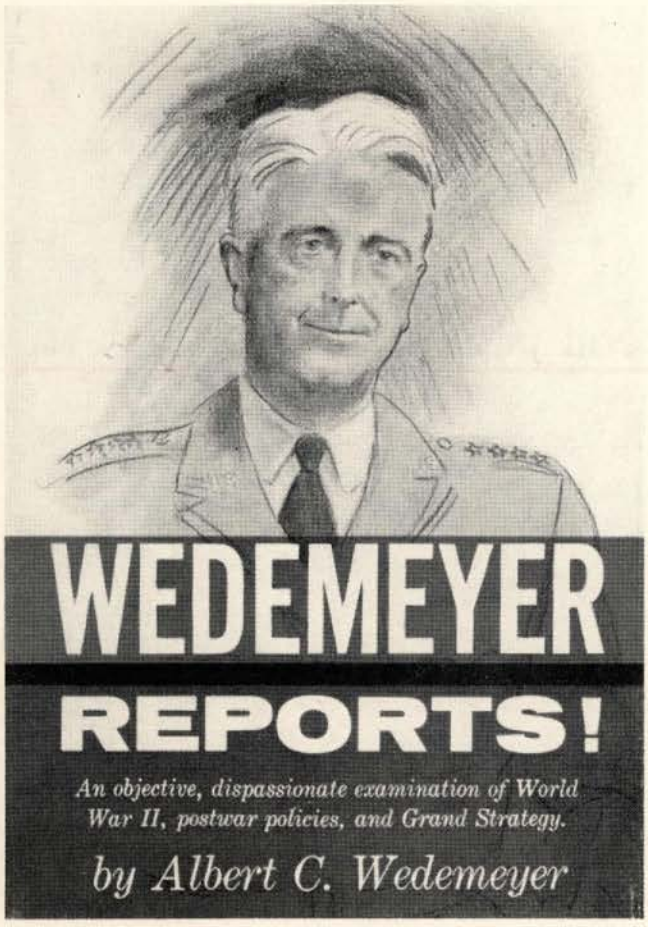
ARMOR

CARDED



JANUARY-FEBRUARY, 1959
80 CENTS

ORDER FROM THE BOOK DEPARTMENT



A book that presents an objective, dispassionate examination of World War II, postwar policies, and Grand Strategy

497 pp. **Price $6.00**

As the United States stands poised "on the brink" of war with Red China and the U.S.S.R., General Wedemeyer delivers a devastating indictment of the Grand Strategy of World War II—strategy which inevitably set the stage for today's world crisis.

In an expert reevaluation, Wedemeyer, a top military strategist, has dared to open the Pandora's box of World War II high command and diplomacy. Powers and personalities emerge in arresting new perspectives as Wedemeyer bares official correspondence and conversations, secret meetings and agreements which foreshadowed the Allied invasion of Europe, the war in the Pacific, and American postwar policy in Asia.

Wedemeyer Reports! is also an objective, dispassionate record of self-examination, spanning a tumultuous period.

Illuminating the report are candid close-ups of great wartime figures; revealing sidelights on the pre-Pearl Harbor newsbreak of General Wedemeyer's "Victory Program" and his subsequent investigation by the FBI; the momentous trip to London in April, 1942, with Marshall and Hopkins; and the postponement of Operation Bolero (the proposed invasion of Europe in 1943) to Overlord in 1944. Perhaps most revealing of all are the disquieting facts behind his famous Wedemeyer Report on China and the Acheson-Truman White Paper which followed.

Condemning a score of tactical and diplomatic errors in World War II strategy—from Churchill's plan for "closing the ring" on Germany to our own bankrupt postwar Asian policy—this logical, documented report by a topflight strategist, commander of American troops in the China Theater and Chief of Staff to Chiang Kai-shek, makes an exciting contribution to modern history.

The United States Armor Association

(Established 1885)

President
LT. GEN. GEORGE W. READ, JR.

Honorary President
MAJOR GENERAL GUY V. HENRY, Ret.

Vice Presidents
MAJ. GEN. DONALD W. MCGOWAN, NG
MAJ. GEN. JOHN L. RYAN, JR.
MAJ. GEN. WM. M. STOKES, JR., Ret.

Honorary Vice Presidents
GENERAL JACOB L. DEVERS, Ret.
GENERAL WILLISTON B. PALMER
GENERAL WILLARD G. WYMAN, Ret.
LT. GEN. EDWARD H. BROOKS, Ret.
LT. GEN. JOHN H. COLLIER, Ret.
LT. GEN. WILLIS D. CRITTENBERGER, Ret.
LT. GEN. HOBART R. GAY, Ret.
LT. GEN. ALVAN C. GILLEM, JR., Ret.
LT. GEN. GEOFFREY KEYES, Ret.
MAJ. GEN. ERNEST N. HARMON, Ret.
MAJ. GEN. JOHN C. MACDONALD, Ret.
BRIG. GEN. SIDNEY R. HINDS, Ret.
BRIG. GEN. WILLARD A. HOLBROOK, Ret.
BRIG. GEN. HENRY CABOT LODGE, USAR
BRIG. GEN. PAUL M. ROBINETT, Ret.
BRIG. GEN. HARRY H. SEMMES, Ret.

Secretary-Treasurer
LT. COL. WILLIAM H. ZIERDT, JR.

Executive Council
GENERAL BRUCE C. CLARKE
LT. GEN. CLOVIS E. BYERS
MAJ. GEN. HOMER O. EATON, JR., NG
MAJ. GEN. ROBERT E. FRANKLAND, NG
MAJ. GEN. LOUIS V. HIGHTOWER
MAJ GEN. ALBERT S. JOHNSON, NG
MAJ. GEN. HARRY W. JOHNSON
MAJ. GEN. W. P. JOHNSON
MAJ. GEN. ALMERIN C. O'HARA, NG
MAJ. GEN. ANDREW P. O'MEARA
MAJ. GEN. ROBERT W. PORTER, JR.
MAJ. GEN. MAXWELL C. SNYDER, NG
MAJ. GEN. THOMAS E. VAN NATTA
MAJ. GEN. EDWARD O. WOLF, NG
BRIG. GEN. CHARLES G. DODGE
BRIG. GEN. JAMES I. KING
BRIG. GEN. HAL C. PATTISON
BRIG. GEN. W. H. S. WRIGHT
COL. FREDERIC W. BOYE, JR.
COL. ANDREW J. BOYLE
COL. JAMES H. CRITCHFIELD, USAR
COL. SAMUEL MCC. GOODWIN
COL. LAWRENCE V. GREENE
COL. WILLARD WEBB, USAR

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR
Lt. Col. William H. Zierdt, Jr.

BUSINESS MANAGER
M Sgt J. William Joseph

ASSISTANT TO THE EDITOR
Sfc Michael E. Kekker

CIRCULATION MANAGER
M Sgt William Coley, Jr.

Volume LXVIII JANUARY-FEBRUARY, 1959 No. 1

CONTENTS

LETTERS TO THE EDITOR 2

EDITORIAL 4

AIRLANDED ARMORED INFANTRY 6
By Major Rolfe L. Hillman, Jr.

REALISM IN A COMBAT FIRING COURSE 12
By Andrew J. Eckles III and Lieutenant Colonel Curry N. Vaughan

THE REORGANIZATION OF THE DEPARTMENT OF DEFENSE 17
By Lieutenant Colonel Ace L. Waters, Jr. and Lieutenant Colonel Jack A. Rogers

IMPROVING OUR CAPABILITIES FOR LIMITED WAR 22
By General Maxwell D. Taylor

RECONNOITERING 24

STEPS IN THE RIGHT DIRECTION 26
By Captain Richard E. O'Brien

COMBAT LEADERSHIP 39
By Major Charles W. Dryer

AMPHIBIOUS TANKS 42
By Eberhard Johannis—Translator: Captain Norbert Brandon

RAPID RECONNAISSANCE, NOW! 46
By Major Harry H. Hiestand

IMPROVED LAND NAVIGATION 50

DELAY AND DEFENSE COURSE 51

NEWS NOTES 52

HOW WOULD YOU DO IT? 55
A U. S. Army Armor School Presentation

FROM THESE PAGES 57

THE BOOK SECTION 58

LOST VICTORIES 58
Reviewed by Colonel Leo J. Meyer, Retired

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and editorial offices: 1757 K Street, N.W., Washington 6, D. C. Copyright 1959, by the United States Armor Association. Second-class postage paid at Washington, D. C. and at Additional Entry. Terms: Domestic subscriptions, including APO's, $4.75—one year and $8.00—two years. Foreign, including Canada & Pan America, $5.50—one year and $10.00—two years.

LETTERS TO THE EDITOR

A Vote Cast for Diesels

Dear Sir:

Let me congratulate Captain Lochrie on his excellent discussion of "Diesels for Armor" appearing in the November-December issue of *ARMOR*. As Commanding Officer of the 634th Tank Destroyer Battalion, attached to the First United States Infantry Division from Normandy to Czechoslovakia, during World War II, I would like to enter the discussion.

The 634th Tank Destroyer Battalion was equipped with and used the M10 Tank Destroyer throughout the European campaigns. This was a Diesel driven vehicle using the three-inch Naval Gun as main armament. There are several points concerning the Diesel in combat that I feel would further solidify the thinking of Armored officers.

The discussion as outlined by Captain Lochrie has little or nothing from the combat side of the picture. I submit some of the advantages and disadvantages of the Diesel in combat.

1. *Exhaust Smoke:* Yes, it is terrific when the Diesel is warming up. In fact that pillar of smoke will draw all the artillery and mortar fire in range. That point is quite easily overcome however. Simply have the Diesel warm up before dawn, as we did daily.

2. *Sound of the Diesel:* Less than the gasoline engine and strangely enough can *NOT* be pinpointed from a distance. The reverberations of the Diesel engine blend with the atmosphere in such a manner that from a distance of 1500 yards it is most difficult to pinpoint exactly where the vehicle is located. This is *NOT* true with the gasoline driven tank. One can point with a great deal of accuracy as to the location of the gasoline driven tank by the sound of its motor.

3. *Backfire:* There is little or no exhaust flash from the Diesel, whereas the opposite is true of the gasoline driven tanks. It was possible to place Diesel driven tank destroyers in position at night on a forward slope in view of the enemy without the enemy finding their position. This is *NOT* true of the gasoline driven engine. The exhaust flash is terrific and can be seen for miles. This exhaust flash will definitely bring down fire.

4. *Explosions of Fuel:* True with gasoline driven tank, *NOT* true with the Diesel. The fuel simply does not explode. Men and vehicle are therefore saved for further action. The only Diesels lost by explosion was when the enemy round touched off the ammunition in the tank destroyer.

5. *Reliability:* The Diesel is a much more reliable, easier to maintain workhorse than the gasoline driven engine in my opinion.

6. *German opinion:* One of the greatest compliments ever paid my battalion was by a German Tank Officer, who when captured and interrogated stated that "The M10 Tank Destroyer with the Diesel motor is the greatest tank the Americans have. We call it whispering death."

Further facts bearing on the problem:

It is my understanding that the real reason the Army gave up Diesels is that Navy claimed all the Diesel production of the country for their small boats, landing boats and barges. This I cannot support.

Further opinion: It is my opinion that the terrific consumption of gasoline now necessary to support an Armored Division in the field borders on the ridiculous. We need a Diesel driven tank using an easily produced, low cost interchangeable fuel, that will give us much more mileage than our present family of Armored vehicles.

My hat is now in the ring in favor of the Diesel engine.

Before closing may I boast that the 634th Tank Destroyer Battalion fought every day with the 1st United States Infantry Division from Normandy to Czechoslovakia. Using the same Diesel driven tank destroyer, losing 18 through enemy action. These 18 were replaced by other Diesel driven M10's. During this period other TD outfits were also attached from time to time. One battalion was re-equipped *three* times with gasoline driven vehicles of different types while the Diesel driven M10's plodded on.

COLONEL HENRY L. DAVISSON
Army Advisor
27th Armored Division NYARNG
29 Masten Avenue
Buffalo 4, New York

More on Diesels

Dear Sir:

I have read with great interest the article "Diesels for Armor" by Captain Arthur J. Lochrie, Jr. in your November-December 1958 issue. This article contains much information of interest and value to my technical personnel here.

I would like to reproduce 100-150 copies of this article for use by the automotive technicians in the Maintenance Branch, Field Service Division, of this Command. This will serve two purposes. First, it will give my people a comprehensive knowledge of the background and factors involved. Secondly, it will aid them in formulating training and maintenance doctrine which will reflect in our information furnished to our customers world-wide.

It is requested that permission be granted to reproduce the article for our internal use within the Command.

LIEUTENANT COLONEL F. H. TERRY
Maintenance Branch
Ordnance Tank-Automotive Command
1501 Beard, Detroit 9, Michigan

● *Permission has been granted. We would like to take this opportunity to correct one big mistake made in this article when we originally published it. At the last minute we realized that we needed some artwork to properly illustrate this excellent material. We contacted the author and Mr. William M. Conn, civilian illustrator at the Reproduction Plant at The U. S. Army Armor School. Captain Lochrie roughed out the sketches and Mr. Conn supplied the fine finished artwork. To both we owe an apology and take this opportunity to express our sincere gratitude.*—ED.

In Support of the AUSA

Dear Sir:

We were delighted to see the fine editorials on pages 16 and 17 of the November-December 1958 issue of *ARMOR*. We deeply appreciate the way

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1959 by the United States Armor Association.

Reprint Rights: All Rights Reserved.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of Armor is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1757 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the even months of the year: i.e., Dec. 25 for Jan.Feb issue, Feb 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

in which you brought the work of our Annual Meeting to the attention of your membership. We are particularly pleased that you have seen fit to urge your members to give their full support to the resolutions.

Certainly, we believe that the resolutions are in the best interest of the whole Army and that if we are to accomplish them, it will take the support of all who have an interest in a strong Army as a vital part of our National defense. The continuing support of the U. S. Armor Association is certainly needed.

LT. GEN. WALTER L. WEIBLE, Ret.
Association of the U. S. Army
1529 Eighteenth Street, N. W.
Washington 6, D. C.

● *As a matter of interest the dates for the next AUSA meeting are the 3rd, 4th and 5th of August 1959.* ED.

Diesels Again

Dear Sir:

The excellent article on "Diesels for Armor?" by Captain Arthur J. Lochrie, Jr., in your November-December issue has created a great deal of interest here at Caterpillar. It contains many ideas our organization is interested in. With your permission, we would like to distribute this to members of our sales group.

May we have your permission to reprint the article, exactly as it appeared in your November-December issue, with due credit to *ARMOR* magazine?

Thank you for your assistance. If we can be of any service, please let us know.

J. E. ROBERTS
Caterpillar Tractor Company
Peoria, Illinois

Armored Cars

Dear Sir:

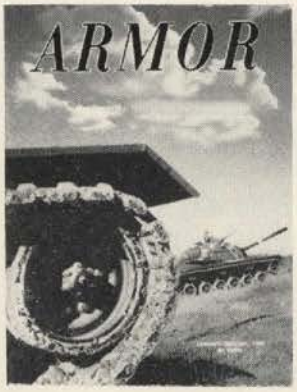
As one who has written over a period of years, in *ARMOR* and in other military magazines, in support of further armored car development I should like to reinforce the plea for armored cars made by Mr. Robert W. Forsyth and Mr. John P. Forsyth in their thought-provoking article "Armor for the Airborne" in the November-December issue. I should also like to add that in addition to airborne operations there are several other fields where armored cars could be employed to great advantage, especially by armored cavalry squadrons, armored cavalry regiments and the National Guard.

Another reason why armored cars and other wheeled armored vehicles should be reconsidered is provided by their extensive and successful use by foreign armies. In this context one should point out that post-World War II development has not been confined to the French 8 x 8 Panhard E.B.R. For instance, Britain has produced the 6 x 6 Saladin and the light 4 x 4 Ferret, the latter in quantity; more recently the Swiss has introduced the 4 x 4 Mowag tank destroyer and the Germans the 4 x 4 Unimog armored car.

The actual armored car which the authors illustrate is open to criticism and, in particular, its weight appears excessive. But, as the authors point out, the proposed design is intended mainly to provoke further investigation and if it succeeds in this it will more than justify itself.

RICHARD M. OGORKIEWICZ
12 Leconfield Ave.
London, S.W. 13, England

● *I would like to point out that Mr. Ogorkiewicz, an outstanding writer and frequent contributor to* ARMOR, *wrote an excellent article on this subject. It was published in the July-August issue of* ARMOR. *(See page 4.) Entitled* "Wheels for Armor," *the author raises the questions, "Have we given lightweight wheeled vehicles a fair test?" and "Will they provide us with the required degree of mobility?"* ED.



THE COVER

The U. S. Army photograph used for the cover of this issue was taken at Fort Knox, Kentucky at the request of the editor. It simply shows M48 tanks in the field conducting a training problem. It has no other significance except that your editor thought it would make an unusual and interesting ARMOR cover.

ARMOR COMMAND

by
Brig. Gen.
Paul M. Robinett

This book presents the activities and observations of an armor commander who was among the first overseas and in action against the European Axis in WW II. Military men will find this book of professional value for it deals with the problems of a small command in the initial campaign against the German-Italian Allies. Among other things it deals with the problems of the meeting engagement and the withdrawal—two of the most difficult operations in war. An important lesson, illustrated by the operations described, is the necessity of providing our troops with armament and equipment which can compete effectively with those of the enemy. Any officer desiring to improve himself as a commander will find many important and helpful lessons in the book. The author's clear narration gives a realistic picture of the vicissitudes, problems and heroic qualities of our men, and their need for the most skillful understanding and constant leadership by all commanders.

$3.95

The Key—the Soldier

For more years than this editor cares to remember, it has been the editorial policy of the Association which publishes the magazine and newsletter to present material authored by members of *all* components of our armed forces including the Regular Establishment and our Reserve Components. This can be attested to by screening back issues of the magazine. In addition, by scanning lists of the Association's officers and council members you will note that there has always been a proportionate share of representatives from each component.

In selecting material for publication we constantly keep in mind the professional needs of members from all components. Generally speaking, innovations in training are applicable to all components with minor exceptions due to Armory training *versus* Field training. Releases on new items of equipment, historical articles and book reviews of professional military works are of importance to all military personnel and civilians who have an interest in the defense of our country. Major unit commanders have confirmed our beliefs that the material published in the magazine and newsletter has been of professional value to their officers and key noncommissioned officers.

Recently, at The U. S. Army Infantry School, USCONARC Commander General Bruce C. Clarke made a key address entitled "The Ground Combat Soldier." In addition to placing the spotlight on the ground combat soldier, General Clarke emphasizes the ONE ARMY attitude. We have made excerpts from his speech which we believe include the essential points:

The paramount concern of the Army is the ground combat soldier. He is the focal point of all our efforts. Organizing, equipping, training, sustaining and supporting him so that he can perform his indispensable role in combat IS the Army role.

This role is equally significant in any kind of war—hot or cold. It is just as important in general war as it is in limited war. For our nation to entertain any notion to the contrary would be dangerous.

The danger could be social as well as military.

More than any other category of personnel in the Armed Forces, the ground combat soldier comes from the general populace. He is the private citizen under arms—the clenched fist of his people.

It is by no idle chance in the history of mankind that the course of democracy parallels the importance accorded the ground combat soldier in the military forces of nations. It is no exaggeration to say that the basic freedoms we now enjoy are closely related to his ascending importance on the battlefield since the Battle of Crecy. Nor is it an exaggeration, in my opinion, to say that the preservation of those freedoms will continue to be oriented by his place in the sun.

Only when men from all of the people are willing and ready to fight and die for freedom does freedom have meaning for them. Only then does democracy thrive. That is the inexorable lesson of history.

Beguiled by the mechanical marvels of an age, it is easy for people to forget the true character of the ground combat soldier's role in war. When free men have been so beguiled in the past, they have slipped back into vassalage. For the ability of the ground combat soldier to play his part in the social scheme of things depends upon the part he is given in the military scheme of things.

It will be a sorry day for all mankind in this supersonic nuclear age of ours should the ground combat soldier ever be deprived of his rightful

place in the hearts and minds and military forces of his people!

In our efforts to avert this danger, a ONE ARMY attitude must pervade all ranks. The ground combat soldier is not a Guardsman, nor a Regular, nor a Reservist, nor a Selectee. He is simply the American fighting man on the ONE ARMY Team. I appeal to every member of the team—civilian and military—to give his cause the enthusiastic support merited by its vital importance to our country.

In consonance with his main thought, we would like to reiterate his appeal to not think of each component as a separate entity but one unified ground element with the prime purpose of preparing the ground soldier for his primary mission—closing with the enemy. Today's periodicals are replete with stories about the development of new equipment. It should be pointed out, however, that never in the annals of military history has a piece of equipment replaced the need for the ground combat soldier. Never has a rifle, an airplane, a tank or an artillery piece supplanted the need for the man on the ground to take and hold an objective. True—all of these items of equipment assist him in his mission—but it still requires the ground combat soldier.

On pages 22 and 23 of this issue we have published extracts of a speech by our Army Chief of Staff, General Taylor. This excellent article is recommended reading and calls for thought and intense study by all members. He gives a five point program to improve our capabilities for limited war. These points are:

- The modernization of appropriate equipment.
- The improved strategic mobility of limited war forces.
- The preplanned use of air and sealift.
- Expanded joint planning and training.
- The publicizing of our limited war strength.

General Taylor stated that this is not purely an Army program but calls for the efforts of our Sister Services as well.

However, for the sake of stressing our one soldier theme, does not each point achieve the end result of bettering the ground combat soldier?

Modernizing appropriate equipment provides the soldier with better tools to accomplish his mission.

Any improvement in strategic mobility ultimately benefits the combat soldier. We in the Army must strive for a decrease in weight, and the other Services must make available the equipment so as to move our combat soldier to the combat area in a hurry in order that he can accomplish his mission.

By knowing what we have available ahead of time in the way of air and sealift we can be prepared to move our combat soldier to the troubled area with a minimum time lag.

The new Defense reorganization is set up to plan and train all our defense forces for an emergency. However, it is the Army's mission, made up of all components, the Active Army, the Army Reserve and the National Guard, that has the primary responsibility of preparing the ground soldier for his primary mission.

The fifth, and last point, and which is as important as all the others, is to publicize our limited war strength so that not only our potential enemy knows that we are prepared, but our Allies as well. To carry this point a bit further, we should also publicize the fact that our ground troops, to include all components, are ready for whatever the emergency might dictate.

Only by carrying these points through to conclusion will we achieve our aim. Regardless of our branch or our component we must pull together to keep this great nation and our Allies free from tyrannical domination. To do otherwise is inviting disaster.

(U. S. Army)

Airlanded Armored Infantry

By MAJOR ROLFE L. HILLMAN, JR.

The same Infantry mounted in armored carriers and teamed with tanks for mobile operations must also be ready to move in aerial vehicles about the battlefield.

——————GENERAL MAXWELL D. TAYLOR

FOREWORD

The potentialities of close cooperation between Armor and Airborne or Airlanded Forces have long been recognized and utilized. As early as 1923, The German Army conducted maneuvers to test the possibility of employing motorized troops in cooperation with airplanes. In 1940, during their march into Belgium, German fixed-wing aircraft landed troops behind Allied lines, materially assisting the Panzer advance. Later the Allies conducted large airborne operations against the Germans, effecting link-ups with massive mechanized and motorized columns.

While our current Armor series manuals soundly state in general terms our capabilities for helicopter-borne operations, I am convinced that we must develop our *actual* readiness to perform such operations thus providing an additional means of sustaining our forward momentum during exploitation. While it may be desirable to utilize normal Infantry in such a role rather than our specialized armored rifle battalions, the former will not always be available.

The airlanded operations conducted during Exercise STRONGARM, as discussed in this article, provided an excellent opportunity to examine objectively this particular means as applied to a separate combat command. Lessons learned however, are equally applicable to combat commands organic to armored divisions. In future wars, either nuclear or conventional, the successful armored division or combat command commander will be one who trains for and utilizes airlanded infantry in advance of his exploiting columns.—COLONEL DELK M. ODEN, COMMANDING OFFICER, COMBAT COMMAND A, 1ST ARMORED DIVISION.

IN a subsequent issue of *ARMOR* the planning, execution and support of Exercise STRONGARM in the Louisiana maneuver area will be covered in detail. From the CONARC troop tests conducted during STRONGARM, of particular interest and significance to Armor leaders is the test of airlanded armored infantry in support of Armor. While air-transportable armor vehicles are not yet with us (though heralded by the T113 Personnel Carrier and M56 Scorpion), Armor as a branch must keep pace in doctrine and in training with the Army-wide emphasis on aerial mobility. This test, with a specific objective of determining the capability of a combat command to execute vertical envelopments assisting the advance in exploitation, is an indication of a means to keep the pace.

The organization and conduct of the test was of necessity oriented to the structure of the major troop unit involved, Combat Command A (CCA), 1st Armored Division. CCA has a basic organization of two Armor battalions and one Armored Infantry battalion. This structure, with the test requiring the commitment of at least two rifle companies and a battalion command group to the airlanded missions, emphasized, perhaps to an undue degree, two basic doctrinal questions. (For task force organization, see *figure 1.*) First, is it feasible or advisable to remove Armored Infantry from their carriers and mission of coordinated support of Armor for the execution of these missions? Second, what is the impact of such withdrawal on the commander's flexibility in establishing the optimum tank-infantry ratio to meet changing situations? These questions are not quickly or easily answered, and for the purpose of this presentation must be dismissed with these general observations:

1. Airlanded operations of any size for support of Armor in exploitation are preferably executed by Infantry or Airborne Infantry, with Armor in its accepted role as a potent link force. However, the speed of situation de-

Tank-Infantry Organization of CCA for Airlanded Operations

TASK FORCE BULLET (Airlanded Force)
1st Armored Rifle Battalion, 6th Infantry (—2 Co's)

TASK FORCE BRIDLE
1st Medium Tank Battalion, 1st Cavalry
Company C, 6th Infantry

TASK FORCE SPUR
1st Medium Tank Battalion, 13th Cavalry
Company A, 6th Infantry

Figure 1.

MAJOR ROLFE L. HILLMAN, JR., Infantry, a 1945 USMA graduate, served in FECOM with the 4th Infantry Regiment from 1946-48. Returning Stateside he served with the 9th Infantry Regiment at Fort Lewis. He accompanied the Regiment to Korea in July 1950. He attended the Advance Class at Benning in 1951 and remained there as an instructor for one year. He next went to Austria where he was Aide to General Arnold. He returned to Fifth Army in 1955. Graduating from C&GSC in 1957 he was assigned as S-3, 1st ARB, 6th Infantry. It was during this period that the tests described were conducted. He has been the Battalion Commanding Officer, 1st ARB, 6th Inf. since this past Oct.

velopment in an exploitation phase dictates that many missions be executed with troops immediately available, else the opportunity has passed.

2. The advantages of having an airlanded *capability* within a combat command seem to be conclusively worth the training effort required and the temporary loss of Armored Infantry from their "track-borne" role.* The mere knowledge of such a capability requires an opposing force to disperse his fighting strength for protection of critical terrain and installations in the rear. Additionally, Armor has its own built-in, link-up capability.

3. The organization of the ROCAD Armored Division, with its four battalions of both Infantry and Armor, as opposed to the imbalance of the tested combat command, one Infantry battalion with two Armor battalions, would permit execution of airlanded missions at battalion strength without unduly disrupting the tank-infantry ratio in organization for combat.

This discussion is not a review of the official evaluation of the test. It must be presumed that the evaluation will receive further study and testing before the conclusions are in the book. Rather, the object is to present, from the participants' view, an approach to conducting airlanded operations with the Armored Rifle Battalion as it is presently organized and equipped. The lessons learned and conclusions drawn are based on a relatively short training period and field maneuver; consequently, they are offered as a point of departure rather than iron-bound solutions to the problems encountered. For Armor and Armored Infantry commanders, present and future, the subject is worthy of continued study and experimentation on a do-it-yourself basis when the opportunity arises.

During the three day Phase II of STRONGARM, the 1st Armored Rifle Battalion, 6th Infantry, supported by the 8th Transportation Helicopter Company of Fort Bragg, North Carolina, executed three airlanded missions to assist the advance of CCA in exploitation. In sequence (see *figure 2*), the operations were:

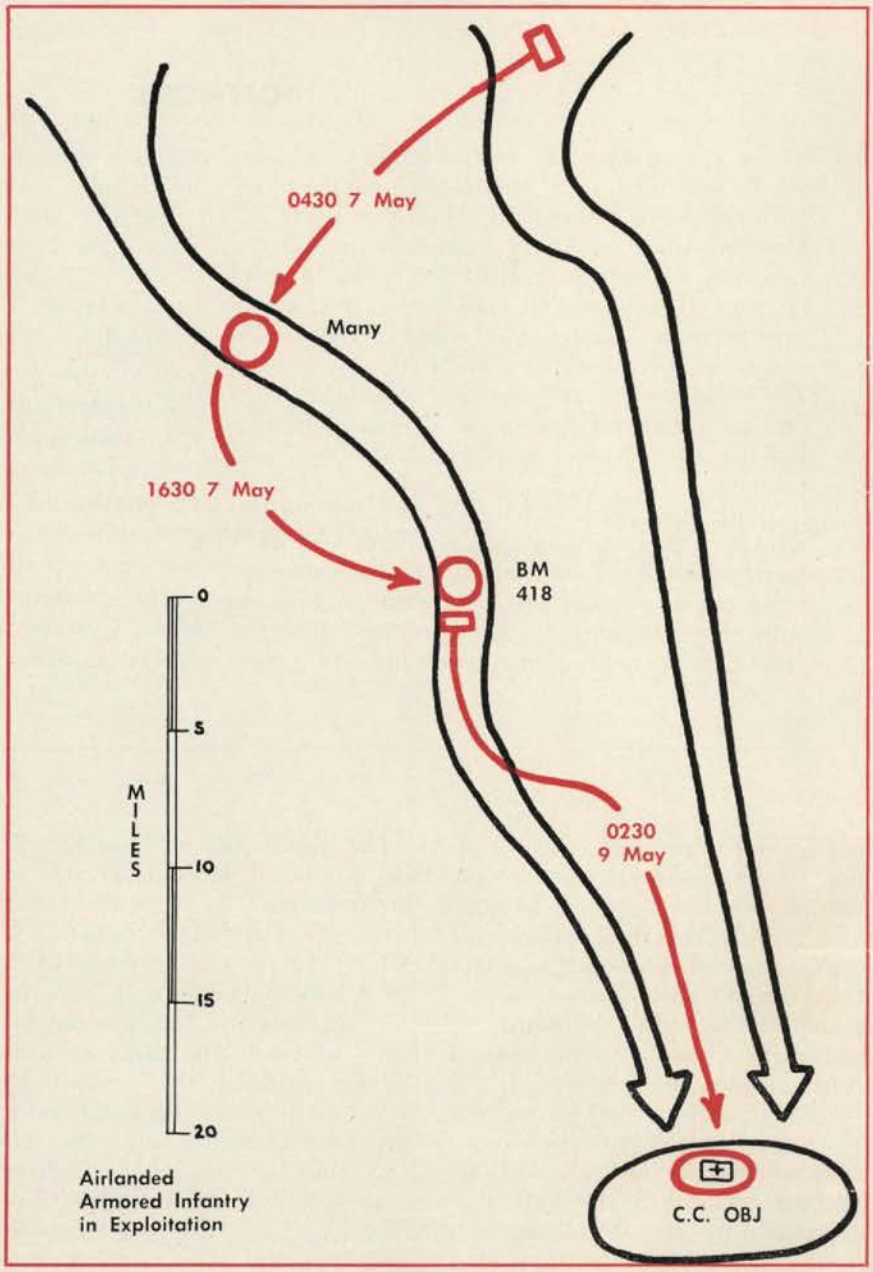


Figure 2.

The MANY Operation: This operation required an 18 mile airlift to seize the road network converging on a town of some 3,000 people. Two days of planning time were available, and a reconnaissance of the objective area was conducted. Weak Aggressor resistance was encountered.

The BM 418 Operation: This operation required an airlift of 12 miles to seize a critical, isolated road junction. The unit was alerted for this possible mission approximately six hours before the operation, with less than two hours notice between the receipt of the firm mission and the airlift of the first serial. There was no reconnaissance of the objective area. There was no Aggressor defense of the objective.

The MILL CREEK CEMETERY Operation: This operation called for a night airlift of 25 miles to seize a critical road junction on the combat com-

* See Section 1, Chap I, FM 17-20, and Section X, Chap II, FM 17-1, "Capability" as used above requires staff and troop trained, and periodically retrained, in airlanded techniques.

mand's intermediate objective. While a one-day planning time was available, the mission was cancelled due to predicted weather, and not reinstated until H-Hour minus three. The objective was heavily defended by Aggressor.

Of these operations, the *short notice* BM 418 landing is considered most typical of what will be required of Airlanded Armored Infantry, and emphasizes what the airlanded training objective must be to attain this high degree of operational readiness. This is in effect saying that we must out-expert the experts.

For the preparation of an Armored Rifle Battalion for the test, the logical process seemed to be the adaptation of the well-tried and documented airlanded procedure of our Infantry brethren. Special Text 57-35-2, *Army Transport Aviation, Combat Operations,* prepared by The U. S. Infantry School, proved to be a well presented and practical guide, although dealing in the main with operations of a larger scale than required for our purposes. We have no argument with these basic procedures, and will dwell only on the alterations made to fit our own requirements. Adaptation was required by the following differences between Infantry and Armored Infantry operations:

1. For the type of missions encountered, less planning and preparation time is available to Armored Infantry; consequently the requirement to *short cut* when and where possible without loss of firm direction and coordination.

2. There is a definite requirement to move the large and vulnerable follow-up echelon of Armored Infantry, such as the Armored Personnel carriers, with a minimum number of control personnel.

3. There are differences in available communication equipment, with the advantage in this instance being with the Armored Infantry.

4. There is a requirement for maximum flexibility in link-up planning for the smaller scale operations, conducted internally by a combat command.

The pre-exercise training program was basically a project of orienting the existing organizational structure to airhead tactics and airlanded techniques, utilizing, where possible, the nucleus of personnel with previous experience as instructors in this specialized field. The conversion to Infantry tactics within the airhead was made prior to the availability of supporting aircraft, as was basic instruction in the vital techniques of day and night assembly. Assuming the preliminary, individual unit and staff training to be effective, there is still no substitute for the experience gained in executing full scale practice landing with supporting aircraft.

At the outset of training, a tentative unit Airlanded SOP was developed, based on the type and number of aircraft estimated to be available, and the anticipated missions. No attempt was made to formalize this SOP on initial distribution, and major and minor changes were made as training progressed. The main requirement was, and is, for a flexible, *usable* guide. Each operation should be carefully reviewed and critiqued, amending the SOP as necessary. One fundamental feature to be incorporated in such a guide is a clear delineation of the responsibilities and procedures of command and staff at each echelon. The resolution of these matters is a large step in attaining speed of execution. As an example, in the training for STRONGARM, it became more apparent with each operation that the Armored Rifle battalion staff was expending a great deal of unnecessary time and effort by publication of a full operations order with numerous annexes. Within the time allowed, the written order, a classified document not to be taken into the airhead in any case, was usually completed long after the assault troops had been briefed on the basis of oral orders to their commanders. The obvious solution was publication in the combat command directive of all necessary instructions for coordination; such as link-up points and alternates, and the no-fire lines between the airlanded force and other combat command units. This procedure hinges on a close coordination between staffs at the time the directive is prepared. The detailed loading and landing plan should be made a matter of record, and thoroughly understood within the assault force; but full publication and distribution at this level was found an unnecessary, time-consuming luxury. The BM 418 operation, considered by all concerned as the most successful of the three, was conducted from a pencilled combat command fragmentary order to the assault force. Distribution of copies of the airhead and link-up point overlay were made to potential link-up units, with recognition and communication procedures following the established SOP.

As a further time saving device, there must be at the directing headquarters (in this case the combat command) a joint planning conference. Representatives must include those from the assault force, the transporting unit, terminal guidance personnel and pathfinders, when employed. The Ground Liaison Officer from the transporting unit should be available to the assault force staff from this time until the completion of the mission. When time is of the essence and distances are excessive such representatives should be flown to the conference site.

Regardless of the time available, there must be a workable plan. Employing the accepted backward planning sequence (ground tactical landing plan, air movement plan, loading plan), the assault force staff must suit its actions to the mission and the time and resources available. In other words they must consider the troops and aircraft available and the number of loading and landing zones. In this period, Armor's well known *deliberate planning, violent execution* may of necessity be amended to read *violent planning, violent execution.*

It must be assumed that prior to the assignment of the mission, the directing headquarters has carefully weighed the size and nature of the objective against the available resources. The intelligence effort becomes at this time, and remains, the keystone of the operation. With the constantly changing dispositions of enemy forces during exploitation, a major effort is required to maintain surveillance of the objective area. It must constantly be kept in mind—what enemy units can be moved into the objective area. This information must be periodically furnished the assault force, with positive means of effecting alternate routes and objec-

tives, or cancellation at any stage in the operation. With the vulnerability of current transport helicopters, especially in the landing stage, it is quite necessary to *"land 'em where they ain't."*

As an integral part of the tactical plan, a delicate problem was the proper evaluation of weapon requirements within the airhead. It was concluded that the requirements will vary from operation to operation, and cannot be made an SOP item. Are 50 caliber machine guns, with additional ground mounts obtained from the headquarters company, worth the burden to assault troop mobility? Can 4.2" mortars be delivered and resupplied within hand-carry distance of firing positions? When should they be brought in? Is sufficient airlift available to bring in a number of the scout platoon's quarter-ton mounted light machine guns? Can sufficient ammunition be brought in to justify taking all 3.5" rocket launchers (13) available to each rifle company? Perhaps the salient conclusion of the weapon requirements for this mission is the well demonstrated need for the long range antitank protection which could be provided by the 106mm recoilless rifle. A recommendation to add this weapon to the TO&E of the Armored Rifle Battalion was submitted at the end of the exercise.

While actual reconnaissance or detailed reports of the objective area are of great value in developing the landing plan, these too must be considered a luxury item. Landing zones selected must utilize the capability of the helicopter to deliver troops on, or adjacent to, the objective; but when selected from map study alone, it must be with the realization that diversion to an alternate zone may be required. In the BM 418 operation, two of the three landing zones selected were denied, by tree growth since map publication. It follows that the small unit leader, each heli-team commander, must be able to move his troops to the assigned objective from an area other than that originally planned. When loading and landing zones permit, the maximum number of aircraft should be landed simultaneously, as piecemeal arrival of aircraft obviously permits even a small enemy defense force an undue advantage.

Airlifted vehicles must be on the end of their respective serials due to decreased speed of the aircraft. The vehicle landings should be planned for an interior landing zone, with thorough driver orientation as to rendezvous points and alternate plans. The great variance in lift capability due to altitude and temperature is also a factor to be considered.

In both landing and loading, organic personnel trained in terminal guidance procedures, and with minimum special equipment, are of great assistance. Assignment of Pathfinder personnel proved especially helpful for night operations.

The air movement plan and the resulting loading plan were developed through joint participation of S-3, S-4, Ground Liaison and Terminal Guidance personnel. Flight routes were coordinated with the Combat Command FSCC. At this point in our operations, the S-3 Air became the focal point. As our SOP placed the Battalion S-3 on a leading aircraft for early control within the airhead, the S-3 Air remained in charge of a provisional Loading Control Group, consisting of the S-4, Terminal Guidance and Ground Liaison, to cope with the embarkation of troop and supply lifts, plan alterations due to malfunctioning aircraft, diversion of flights and the many other perversities of fate. This required, on the S-3 Air's part, a comprehensive and detailed knowledge of each part of the plan. The problems of the loading control group were greatly magnified during night operations, although the same procedures applied. Daylight orientation of troops in the loading areas and dusk arrival of aircraft are to be desired.

For the protection of the loading zones, and subsequently of the follow-up echelon, it is desirable, but not always possible, that a tactical unit, preferably a tank company, be attached to the airlanded force. If made available, the attached unit should have primary responsibility for this security. The M59 APCs of the airlanded force and the elements of the Scout and Mortar Platoons not airlifted should assist in this mission and be prepared to assume the entire task.

The follow-up echelon (the 17 M59's of each airlifted company, battalion headquarters and headquarters company minus the airlifted command group and other wheeled vehicles not lifted) was placed under the control of the Battalion Executive Officer. While this group can attain a degree of security by following closely on the axis of a lead task force, a pre-maneuver practice operation indicated its vulnerability to by-passed Aggressor troops and Aggressor air. We believe this problem would be greatly diminished within the more flexible assets of a full ROCAD Division. Despite the need to place the maximum fighting strength of a rifle company in the airhead, our final decision was to leave one rifleman in addition to the driver with each M59. Additionally, it was felt that the Rifle Company Executive Officer is best assigned to the follow-up echelon. This officer should work directly with the loading control group until all elements of his unit are lifted, thereafter reporting to the Battalion Executive Officer for control of movement of the land tail. The follow-up echelon, in addition to assisting in security, must furnish to S-4 the personnel required to prepare and load vehicles and supplies. It was found unnecessary to issue a written order for movement of this group.

These personnel were determined to be the minimum Battalion Command Group to be airlifted initially for operations of this size:

Battalion Commander
S-2
S-3
Operations Sergeant
Operations Specialist
Battalion Supply NCO
Communications Officer with three radio operators
Battalion Surgeon with four aid men
Drivers for airlifted vehicles
Umpires, observers and VIP's, as the situation requires

This structure leaves the Executive Officer with sufficient staff capability for short term operations.

As can be envisioned, the success of these operations was dependent on effective communications. *Figure* 3 indicates the basic plan and the priority of vehicles to be lifted into the airhead, but it does not attempt to present the numerous alternate possibilities. Communications planning must be instituted and directed from the combat command level un-

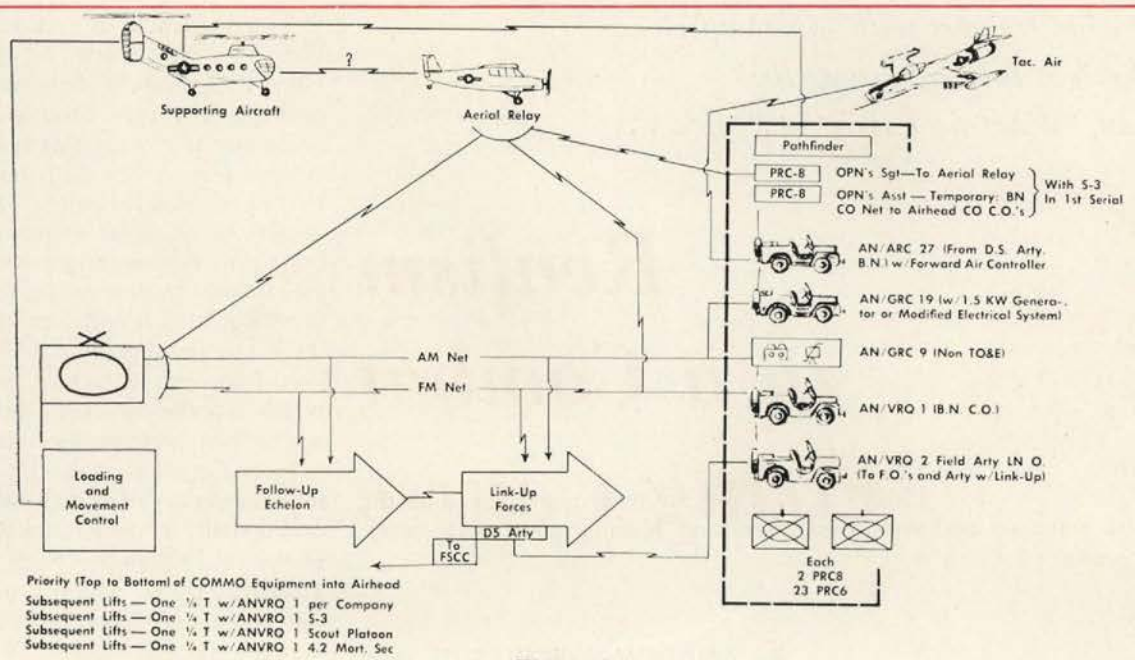


Figure 3.

til both assault and link-up forces are thoroughly grounded in the procedures. In *figure* 3, three deviations from the TO&E equipment of the Armored Rifle Battalion require comment.

The quarter-ton truck mounting the ANGRC19 was fabricated by mounting the 19 in the vehicle of the Chaplain—a reasonable and tolerant man—and hand-carrying a 1.5KW generator to power the set. For short periods of time, the regular electrical system will do the job, but this is not an approved solution. A better one would be to modify the vehicle system to 100 amps. (The use of this AM set mounted on a quarter-ton vehicle, to operate with the forward command group in normal ground operations, was a by-product of great value.)

The ANGRC9 with hand-cranked power was obtained from without the combat command as an experiment in alternate means of AM communication, and proved effective.

The necessity of borrowing from the Artillery a quarter-ton mounted ANVRC27 for control of tactical air was made doubly apparent when, on the MANY operation, this vehicle was dropped on take-off from some 50 feet up. This type of mishap places a rather severe strain on normally cordial relations, but, of more immediate importance, no substitute was available and the vital early protection of the airhead by tactical air was thus lost. It was likewise repeatedly emphasized that a fixed wing aerial relay should be on station within range of the airhead at the time of landing of the first elements, with a secondary mission of reconnaissance as requested by the airhead forces. This aerial relay gives the S-3 with his PRC8, prior to the arrival of vehicular mounted radios, an immediate means of contact with an FM net and at the most critical stage of the operation. Firm radio discipline must be imposed as the link-up approaches. With the airhead force and the advancing task forces fully occupied with enemy action and link-up coordination, the combat command operation, intelligence and command nets are fully taxed. In the MILL CREEK CEMETERY Operation, the situation bordered on the chaotic due to spectacularly effective voice and electronic jamming and combat (umpire) loss of all AM means. We found the two PRC8 radios at the rifle company to be inadequate for this type mission, and suggest substituting at least four more PRC8s for present X PRC6s.

The short training and test period left several aspects requiring further study and resolution. There must be for each operation a clear statement of authority to divert or cancel the mission. At various phases it may be necessary that either the Pathfinder Team Leader, Senior Airlanded Force Officer or Combat Command Commander exercise this authority. Logistically, further study is required in determining optimum amounts of initial lifts and type loads for subsequent lifts, with contingency plans for continued logistical support from combat command agencies if link-up is delayed. In addition to continued emphasis on obtaining the most from our communications equipment, we must find a more satisfactory solution to ground and in-flight control of aircraft at both ends of this operation.

We again point out that the experiences of STRONGARM do not justify final conclusions or firm concepts, but we also submit that in the retrospective view of the participants, the tests indicated that an organic capability for airlanded operations gives the armor commander a valuable additional means of assuring the success of his mission.

To provide trainees with some experience which might help to answer the question, "What do I shoot at?" use . . .

Realism in a Combat Firing Course

By ANDREW J. ECKLES III, and LIEUTENANT COLONEL CURRY N. VAUGHAN

THE tank company, reinforced by infantry, crossed the line of departure. In the attack position the attacking unit has been informed of the known and suspected positions of the enemy's antitank (AT) weapons in the area. The reinforced tank company's job: destroy the enemy weapons. The attacking unit utilizes the terrain to move against the enemy. Tank commanders scan the possibilities as the medium tanks move. The scant concealing trees give way to open, flat terrain. The tanks grind to a halt in hull defilade and the infantry dismount.

Tank commanders report to the platoon leaders that the area of the objective is apparently free of enemy. The company commander, after receiving this report, orders two platoons to move onto the visible objective and the third platoon to overwatch.

Two tank platoons, HE in the chamber and battle sight in readiness, move out from the protection of the hull defilade position. As they move into the flat terrain, a blast from an enemy AT weapon is heard and the smoke from the enemy weapon is seen 350 yards to the front.

Fire commands are spoken into the inter-com. Target! The only target visible is the drifting smoke from the enemy AT weapon, and if the gunner looks closely enough, the bright, black muzzle of the AT weapon can be seen immediately behind the smoke. As the tank commanders rapidly give orders, another enemy gun opens fire from a range of about 500 yards. Vital seconds pass as the gunners scan the apparently empty terrain, and the enemy weapons continue to fire at the attackers. One of the gunners shouts over the intercom, "What am I supposed to shoot at?"

The battlefield is confusion. Seldom does one clearly see his target —a puff of smoke, a slight movement, perhaps. Yet very little training is given our troops for this type of situation. Instead, we train our people to fire at clearly visible, stationary targets, or at most, a clearly visible pop-up or moving target which contrasts considerably with the background so that it will stand out well. This is a considerably different situation from the one just mentioned which actually occurred a few weeks ago at Fort Stewart, Georgia.

In conjunction with the research requirements of The Operations Research Office of Johns Hopkins University, the Training Staff at Fort Stewart, Georgia now has under development a new concept in a combat training exercise which, it is felt, can provide the basis for adding a previously impossible degree of realism to the Armor training program.

This new combat firing exercise, developed jointly by the officers at Fort Stewart and the scientists at ORO, is essentially a modification of the Tac-5 Exercise firing phase of the company ATT, conducted as a normal part of the post-cycle unit training program. This exercise involves a tank platoon and dismounted infantry in an attack on the same axis. It is one of the few live fire exercises which involve tactical cooperation between tank, infantry and supporting weapons.

As previously conducted (before the beginning of the joint Fort Stewart—ORO program) this was a typical "range-type" tactical firing exercise. The targets were standard 6 x 6 panels representing tanks and 3 x 5 panels representing AT weapons. All targets were clearly visible to the attacking units, who could leisurely open fire upon command of the umpire or safety officer.

As a result, since not everyone can become excited about tearing invisible (at long ranges) holes in cloth targets, motivation for a rapid action and enthusiasm in the training program was not always what we desired.

But the conditions of this new exercise, as presently conducted by personnel at Fort Stewart, are different. The targets used are much more realistic. They are not readily visible to the trainees; but concealed, as a sim-

MR. ANDREW J. ECKLES, III, received his BA and MA degrees from the University of Louisville, Kentucky. He has been engaged in research work on Armor problems since 1952. He was a member of project ARNO Team. He worked on the United States Army Armor Human Research Unit at Fort Knox during the period 1952-54. He is presently engaged, in conjunction with Armored personnel at Fort Stewart, in the project he describes in this excellent article and is a member of the Armor Group, Operations Research Office, Wash., D. C.

LIEUTENANT COLONEL CURRY N. VAUGHAN, Armor, graduated from Cumberland University, Tennessee. During World War II he served in Europe with the 3d Cavalry Regiment. Subsequently he served in the 2d Armored Division. Next he went to the XXIV Corps in FECOM. After a short tour at Knox he went to Europe with the 2d ACR. After attending C&GSC he became operations officer at the School at Knox from 1952-55. Graduating from AFSC he was assigned to MAAG, Saudi Arabia prior to becoming Commanding Officer, 17th Armor Group.

ilar target would be in combat. The first indication which the tankers have of a target is usually when they are fired upon—and before they can return accurate fire they must first pinpoint their target. (And this, incidentally, is usually the first situation in which tankers must face the problem of target acquisition in a live fire situation.) And finally, the targets now used at Stewart, are killable—both by sub-caliber fire and by fragmentation.

Essentially, a one sided, company sized battle is waged, using live ammunition, and with realistic, killable targets which initiate the engagement by firing upon the trainees. And all this is done with no additional increase in the cost of the training program (instead, there will probably be an over-all decrease in the actual cost of this much more realistic training).

Before describing the Fort Stewart combat firing course, we would like to describe in some detail the target system required.

The primary target system employed in this exercise represents an enemy antitank gun position. It consists of the following parts:

1. An AT gun tube—in reality a 90mm fiber shell packing case slipped over a stick;
2. A gunfire simulator control box, which detonates half pound blocks of TNT, or gunfire simulators, on command, and
3. Balloon-type killable targets.

A typical gun position is shown on this page. It is served by realistic crewmen, and is capable of simulated firing on the attacking tanks upon command of the control officer. This new target system is used in place of the standard penal targets or old tank hulls normally used in range-type training programs.

The two items of primary interest in the above target system are the simulated control box, and the killable target. And while both these are still undergoing development and improvement by Fort Stewart and ORO, we will describe the equipment presently used for the benefit of others who might be interested in incorporating these into their own programs.

The simulator control box was originally designed by the Electronics Laboratory of the Operations Research Office. In both design and operation it is simple and rugged. All the equipment used on this exercise, for example, is built by Stewart Post Signal Personnel, where safety devices and other improvements were incorporated into the original ORO design. The cost of this apparatus to the Post is negligible, since it was designed to be constructed of salvage parts and equipment.

The simulator control is operated by dry cell batteries, and each control set will fire up to 15 charges over one pair of standard field phone wire, at ranges up to five miles. Normally, one set of controls is used for each gun position, but we often have

(U. S. Army)

Here is a typical gun position showing relative target sizes.

(U. S. Army)

The simulator control firing box.

employed one control set to fire the simulators at several gun positions.

(Schematic diagrams of the Simulator Control are available from the authors for those who are interested in utilizing this type of equipment at their own installation for the development of similar types of training programs.)

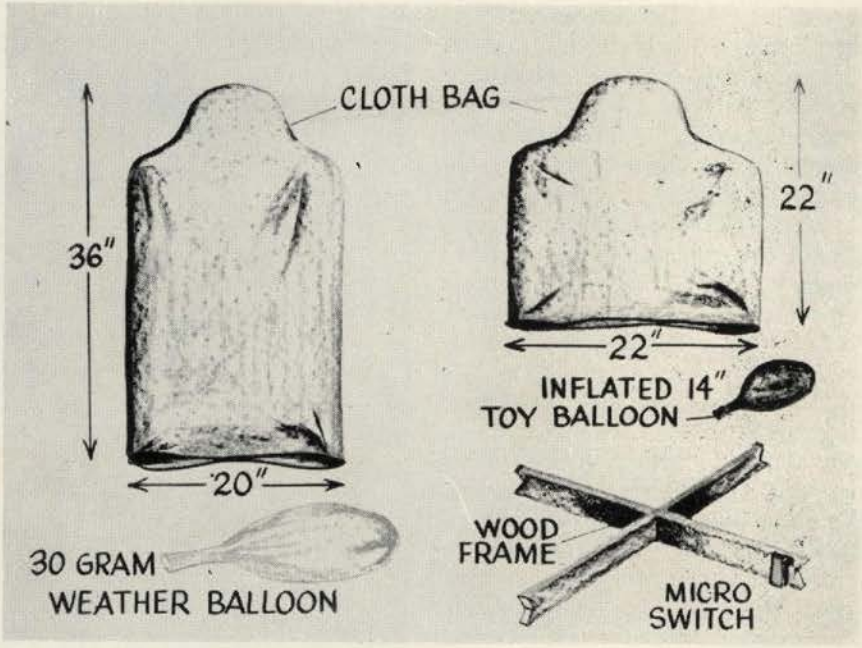
The charges presently used have been half pound blocks of TNT; primarily because of availability. But more suitable gunfire simulators are currently available on special order.

The other important item required in the conduct of this program is the killable target. There has long been a need for a killable target for use both in training and in research. For the purpose of training, a killable target adds realism and interest. For the purposes of research, only a killable target can provide performance data under quasi-combat conditions.

A suitable target should, if possible, have the following characteristics:

1. It must be killable, so that when hit by a casualty-inflicting projectile or fragment it no longer presents a live target to the firer.
2. The target must be suitable for use with small arms fire as well as with fragmenting weapons such as HE fire, hand grenades, etc., so that an entire weapons system complex might be studied as a whole under quasi-combat conditions.
3. The target must be capable (for research purposes) of recording the time of its death, and then fail to record additional hits or overkills.
4. The target system must be simple and easy to set up and use in a field situation, so that much or all of the required work might be performed by the range personnel normally available for the conduct of a tactical exercise.
5. The target must be cheap enough to use on a large scale.

For use with small arms only, there are currently available several types of killable targets (e. g., the "Punchy-Pete" of HumRRO, the "Cockey Ken" of ORO, etc.) which are much more useful under a given set of conditions (i.e., an established range set-up to handle the elaborate equipment required, etc.). However, these targets are not suitable for use with exploding or fragmentary types of weapons such as HE fire, mortars, hand-grenades, etc.; or for use with any weapons system complex which includes such exploding or fragmentary weapons.



Target components.

We now feel, however, that we have under development a target system which fulfills to a very large degree all the above mentioned requirements. The basic target is simplicity in itself—consisting only of a toy balloon of appropriate size, and a canvas or target-cloth covering sewn to the desired shape and size. So far, we have used targets of two sizes—one representing the head and shoulder area, and the other representing the head and full torso. The target bags can be used many times (with the fragment or bullet hole marked with grease pencil) except for very infrequent direct hits by exploding shells.

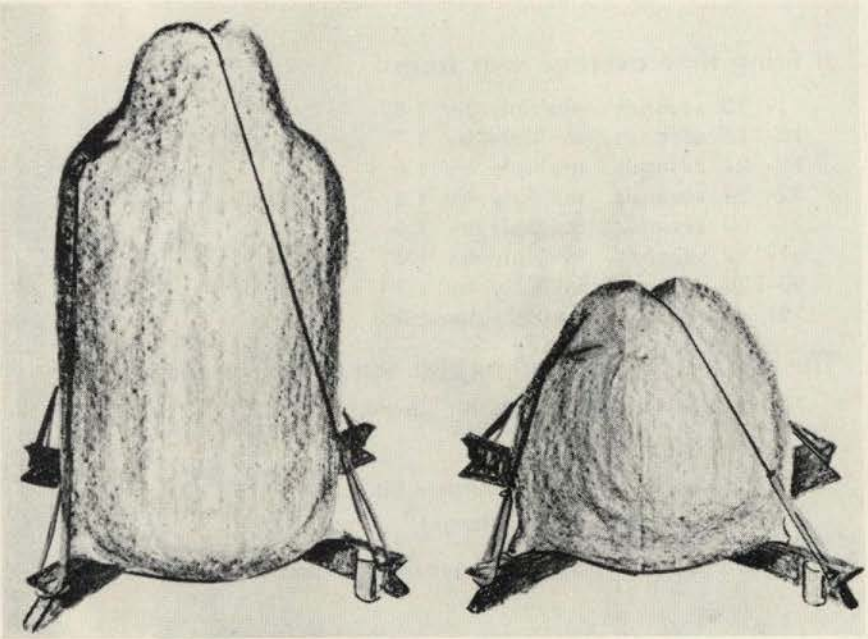
The cloth covering adds amazing properties to a toy balloon. Our target is extremely resistant to shock, blast and small, long-velocity fragments. However, small arms fire and high velocity fragments penetrate the target bag, rupture the balloon, and the target immediately falls to register a kill. In addition, a record of what caused the kill (fragment or bullet, for example) and the location and number of hits are obtained.

As you can see, this provides us with a fairly realistic target except for psychological factors. And we feel that its potentialities for both research purposes and training purposes are quite great.

Our target is three dimensional, conforms in shape and size to the human form, can be outfitted with such equipment as helmet, armored vests, etc., is not disturbed by blast and shock, and is more realistically killable than any other target currently available. And most important, perhaps, the target is cheap enough to be used on a large scale for tactical training as well as for the purposes of research.

The target components are simple enough and cheap enough to be supplied by the local post.

We have successfully used our target with the following weapons: Rifles, machine-guns, mortars, 90mm HE and 155mm howitzers. The principle has, we feel, been demonstrated—though the potential use of such a target is unlimited. Think, for a moment, of the variety of individual programs which could be developed for company training if each company commander was provided with an annual allotment of this type target for use on bivouacs. They could design their own programs to demonstrate the effectiveness of various types of area fire, etc.; with exercises which would provide a great deal more motivation and enthusiasm than



Targets inflated, mounted and ready for use.

shooting at a mere piece of paper.

As we mentioned earlier, the entire program is still under development; and improvements are made after the lessons learned from each run. So far, the use of our killable targets permits us to involve both infantry and support weapons, such as mortars and artillery, in a coordinated attack. In our present program, as the tank infantry team crosses the LD, a forward observer moving with the infantry calls for supporting fire on a concentration of enemy infantry dug in on one flank of the objective. The enemy is represented by a platoon of 25 head and shoulder killable targets. These targets are all in clear sight of the FO, but not, of course, of the firing support weapons, and distributed about in a tactically logical order. It is the task of the FO to adjust fire on the target area, then call for fire for effect. Not only are the supporting weapons racing against time during this problem, but they have a rather realistic target to fire at, and are provided with information as to the number of kills they inflicted—considerably more motivating and useful than merely trying to hit an area. And the eagerness of the participating troops is very heartening to a training officer.

We would like to describe, in some detail, the combat firing program as now conducted at Fort Stewart.

Execution of a Live Fire Problem

The execution of a live fire problem requires the installation of the enemy weapons on a range where the tank gun, 90mm, can be fired in conjunction with caliber .30 coaxial machine guns. The control officer must know the precise capabilities of the range fans and the unit must be instructed on how to approach the problem area in such a manner as to be within the firing limits during the attack. This normally can be controlled by the position of the attack position, the line of departure and emplacement of the enemy weapons. In addition, crews must be informed to fire only within their own safety limits.

As the tank company attacks, the control officer allows the firing tanks, roughly two tank platoons, to move out on line. When the tanks reach a pre-selected area, known to the control officer, the control boxes are activated by the control officer and the first enemy AT weapons in each lane fire one round at the approaching tank platoons.

As the friendly tanks halt, fire commands are given and gunners lay on target. As the attacking platoons take the first enemy weapons under fire, another enemy AT weapon, at a different location and at a different range, fires at the attacking unit. This causes some tanks to shift fires to insure that area fire, with proper distribution, is maintained. The first weapons, enemy #1, and the second weapon, enemy #2, continue to fire until a total of three rounds are fired from each weapon. The enemy positions #1 and #2 are placed ap-

(U. S. Army)

The execution of a live fire problem.

proximately 350 to 800 yards from a pre-selected point.

As recommended by ORO, each tank is issued two rounds of 90mm HE per target area and a total of 250 rounds cal .30 4 x 1 MLB per run.

After the tanks have completed their firing on the enemy #1 and #2 target areas, the tank company commander orders his tanks to "continue on mission." Again when the tanks reach a pre-selected firing point, the control officer fires enemy #3 in each firing lane. Enemy #3 is approximately 1000-1100 yards from the firing point. Again the tanks take the enemy under fire and expend the remaining ammunition. The tank company commander then organizes his objective and the problem continues or terminates in accordance with the company test.

Scoring

The control officer, or any designated officer, moves into the target area and scores the run. The effectiveness of fire is based on the scoring system contained in ATT 17-67, as modified by the 17th Armor Group, stationed at Fort Stewart. The modification includes a multiplication of the results based on reaction time. As the tanks move into the attack and enemy #1 fires at the attacking tank, assistant control personnel equipped with stop watches record the number of seconds from the first round from enemy #1 until the attacking tanks return fire. This is repeated on enemy #3. The times are recorded and averaged. The average time, based on eight companies and the early experimentation and one demonstration, is now approximately 24 seconds. It is recognized that this average time is too great. However, this range is completely new in every respect and, despite a thorough orientation immediately preceding the test, individual tank crewmen are dubious in the approach to the firing phase. Trained in firing at visible targets of some size, and disbelieving that a fragile balloon can even be considered as a target, the tank crewmen are frustrated individuals when their only target is a barely discernible gun that is indicated only by a blossoming cloud of black smoke.

After arriving at a percentile figure based on targets hit, that percentile figure is multiplied by a figure based on the table shown on this page.

If firing time average was from:

1- 15 seconds	multiply by 1.8
16- 18 seconds	multiply by 1.7
19- 21 seconds	multiply by 1.6
22- 24 seconds	multiply by 1.5
25- 60 seconds	multiply by 1.4
61- 89 seconds	multiply by 1.3
90-120 seconds	multiply by 1.2
121 or over	multiply by 1.0

The end results work out as outlined in this sample:

1. Number of AT targets hit (area) 2 — 33%
   Number of ATT targets 6
2. Number of personnel targets hit 5 — 20%
   Number of personnel targets 24
3. Multiply by 1.6 (if time was 20 seconds) 53 x 1.6 = 84.8%
   (if time was 90 seconds) 53 x 1.2 = 63.6%

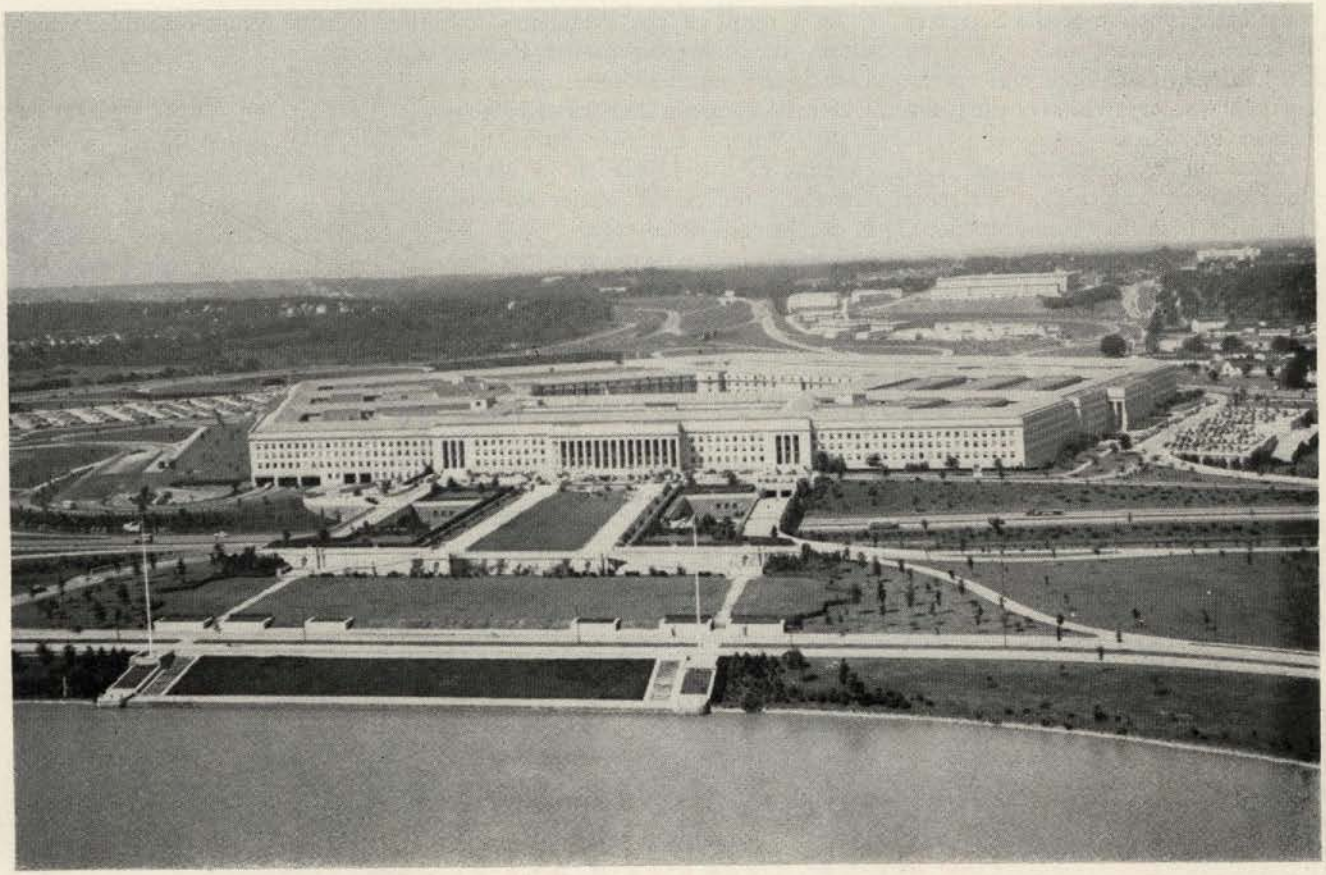
The firing score, when computed with the tactical score as outlined by ATT 17-67, can substantially add to, or subtract from, the overall score sufficiently to change the overall rating.

The final goal of this joint program, both for ORO and for the Training Staff at Stewart, is the conduct of a realistic, one-sided small-scale battle involving a total weapons system complex (i.e., tanks, infantry, mortars, artillery and eventually even close tactical air support). The motivations for achieving this goal are, of course, different for the two agencies. Fort Stewart is primarily interested in providing the most realistic training program possible for combined arms actions in order that they might teach the value and techniques of tank-infantry support weapon cooperation in a combat situation. The ORO, on the other hand, is primarily interested in obtaining realistic performance data on a variety of weapons-systems for use in their analysis of future combat actions.

It is felt that the mutual cooperation between ORO and Stewart through this technique of SYMBION (i.e., superimposing scientific research methods and data collection techniques on selected phases of the Army Training Program) has provided a potentially useful training and research tool. Already the use of this technique has provided one of the most realistic Armor training exercises presently available. And this exercise serves as a continuous source of much needed performance data for the war gaming programs of the Operations Research Office.

Summary

In summary then, we feel that this type program provides, for the scientist, a source of vital numbers for use in the analysis of future combat situations. For the trainees who undergo this type of training exercise, it will provide some experience which might help to answer the question, "What do I shoot at?" when he first comes under fire. Combat experienced tankers know that those who live through their first engagements soon learn the answer to this question—but this is learning the hard, costly way. Here at Fort Stewart, we feel that we are developing a method of teaching this information to our crewmen before their first actual firefight, with a consequent saving of men and tanks in any future war.



The Reorganization of the Department of Defense

By LIEUTENANT COLONEL ACE L. WATERS, JR. and LIEUTENANT COLONEL JACK L. ROGERS

WHAT do you know about the reorganization of the Department of Defense? What does it mean to the Army? The purpose of this article is to answer these questions in order to keep the readers of *ARMOR* abreast of a situation which involves all of us.

The reorganization stems from the President's Message to Congress on 3 April 1958 in which he outlined his principles for the defense of our country as follows: "First, separate ground, sea, and air warfare is gone forever. If ever again we should be involved in war, we will fight it in all elements, with all services, as one single concentrated effort. Peacetime preparatory and organizational activity must conform to this fact. Strategic and tactical planning must be completely unified, combat forces organized into unified commands, each equipped with the most efficient weapons systems that science can develop, singly led and prepared to fight as one, regardless of service. The accomplishment of this result

LIEUTENANT COLONEL ACE L. WATERS, JR., Armor, served with the 158th Infantry Regimental Combat Team in the Pacific during World War II. After the War, he served with the 1st Cavalry Division in Japan. Returning Stateside, he was assigned to the 2d Armored Division, later to the newly activated 1st Armored Division at Fort Hood. He attended the Advance Course at Fort Knox and then went to Germany where he again served with the 2d Armored Division and then in G3, V Corps. Graduating from C&GSC in 1957, he is assigned to the Office of the Deputy Chief of Staff for Military Operations, Department of the Army.

LIEUTENANT COLONEL JACK A. ROGERS, Artillery, served in Europe during World War II. Subsequent to the War he served a tour in the Caribbean, then attended the Advance Course at the U. S. Army Artillery School. Graduating from C&GSC, Fort Leavenworth in 1954 he was assigned to Korea, later to the G-3 Section, AFFE-Japan. Returning to the States he attended the Armed Forces Staff College in Norfolk prior to his present assignment in the Office of the Deputy Chief of Staff for Military Operations, Department of the Army.

is the basic function of the Secretary of Defense, advised and assisted by the Joint Chiefs of Staff and operating under the supervision of the Commander in Chief.

"Additionally, Secretary of Defense authority, especially in respect to the development of new weapons, must be clear and direct, and flexible in the management of funds. Prompt decisions and elimination of wasteful activity must be primary goals.

"These principles I commend to the Congress. In conformity to them, I have formulated and urgently recommend certain changes in our Defense Establishment. Clearly we should preserve the traditional form and pattern of the services but should regroup and redefine certain service responsibilities."

As a result of the President's request, the Congress passed Public Law 85-599, entitled "Department of Defense Reorganization Act of 1958." I shall not attempt to describe the contents of this legislation in detail but there are certain major aspects of it that are of interest.

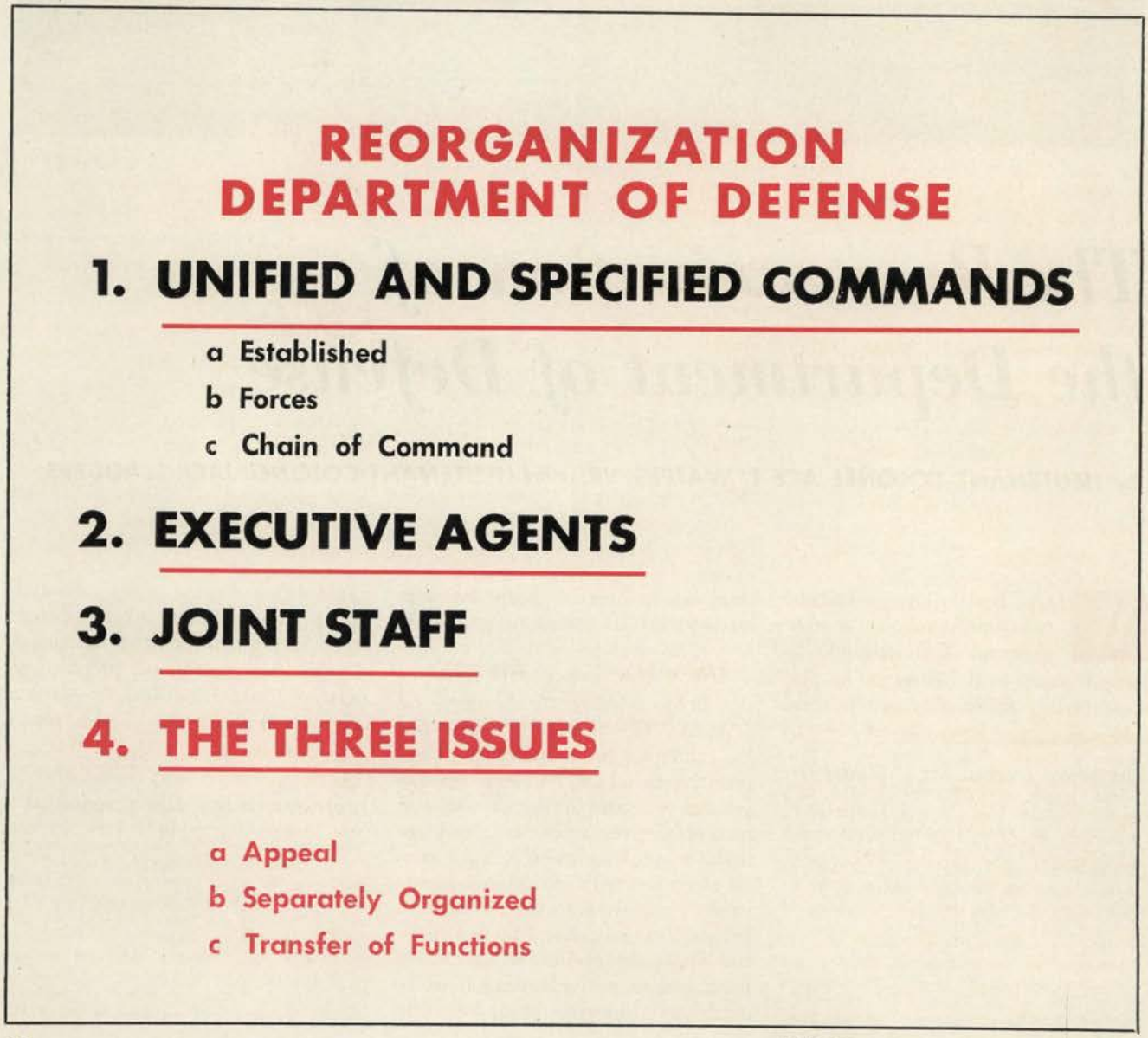
The key areas involved in the reorganization of the Department of Defense are shown on this page. You will note that item 4, entitled "The Three Issues," is printed in red. This highlights the fact that in spite of the publicity at the time, these were the only really controversial matters.

Unified and Specified Commands

The first key area involves the Unified and Specified Commands, their establishment, their forces, and the chain of command under which they operate.

Authority for Establishment of Commands

The Administration proposed that the authority to establish Unified and Specified Commands be vested in the President. There was never any controversy over this matter and both the House of Representatives and the Senate versions of the legislation provided the necessary authority. As a consequence, the President, through the Secretary of Defense, has the authority to establish such Unified and Specified Commands as he may consider necessary in the interest of national security. Insofar as is known there are, at the moment, no plans for the establishment of Unified or



Specified Commands other than those now in existence.

Force Structure

The reorganization also provides that the President, through the Secretary of Defense, shall determine the force structure of the Unified and Specified Commands and that the military departments shall then assign forces to the appropriate commands. There was no controversy over this facet of the reorganization, although it represents a rather important departure from past procedures. The most notable aspect of this provision is that the forces available to the Commander of a Unified or Specified Command are assigned to his command and under his full "operational command." The Unified or Specified Command will therefore have more authority over the service components than heretofore. The exact authority of the Commander of the Unified or Specified Command must await a definition of the term "operational command." However, as a matter of interest, although the term "operational command" has not yet been defined by the Joint Chiefs of Staff, the Congress equated it with the joint dictionary definition of "operational control."

The administration of forces assigned to a Unified or Specified Command remains with the parent military department, but the support of such forces may be assigned by the Secretary of Defense to one or more of the military departments.

Once assigned to a Unified or Specified Command, forces may not be removed except in accordance with procedures established by the Secretary of Defense. At the present, no such procedures have been established. Centralizing the authority for assignment and reassignment at Presidential level, or more probably in actual practice at Secretary of Defense level, will require thorough coordination between what we might call the strategic and budgetary elements of the Department of Defense. Unless there is close coordination, economy measures or strength cuts could impair the support by the military departments of the forces they are required to maintain assigned to the Unified or Specified Commands. For example, divisions assigned to Unified or Specified Commands would suffer if the training base were drastically reduced, or if strength cuts forced a reduction in essential support or service units. This latter situation could easily come about if strength cuts are not coordinated with strategic assignments, as the major combat units will be assigned to Unified or Specified Commands and hence are relatively "immune" to deactivation and skeletonizing, leaving only supporting elements to absorb the cuts.

PHASE OUT SCHEDULE

The Army for CINCEUR—15 September 1958

The Air Force for CINCAL—1 December 1958

The Army for CINCARIB—1 December 1958

The Navy for CINCPAC, CINCLANT and CINCNELM—1 January 1959

The Air Force for CINCSAC and CINCNORAD—1 January 1959

Chain of Command

The last major provision with respect to the Unified and Specified Commands is that these commands are responsible to the President and Secretary of Defense for such military missions as may be assigned by the Secretary of Defense, with the approval of the President. This chain of command omits the Joint Chiefs of Staff and the military departments. However, the Joint Chiefs of Staff will act for the Secretary of Defense in most military matters, and the Joint Chiefs of Staff plan for implementing the reorganization provides that the Commanders of Unified or Specified Commands and their Service Component Commanders may deal directly with the military departments on matters of purely uni-service interest.

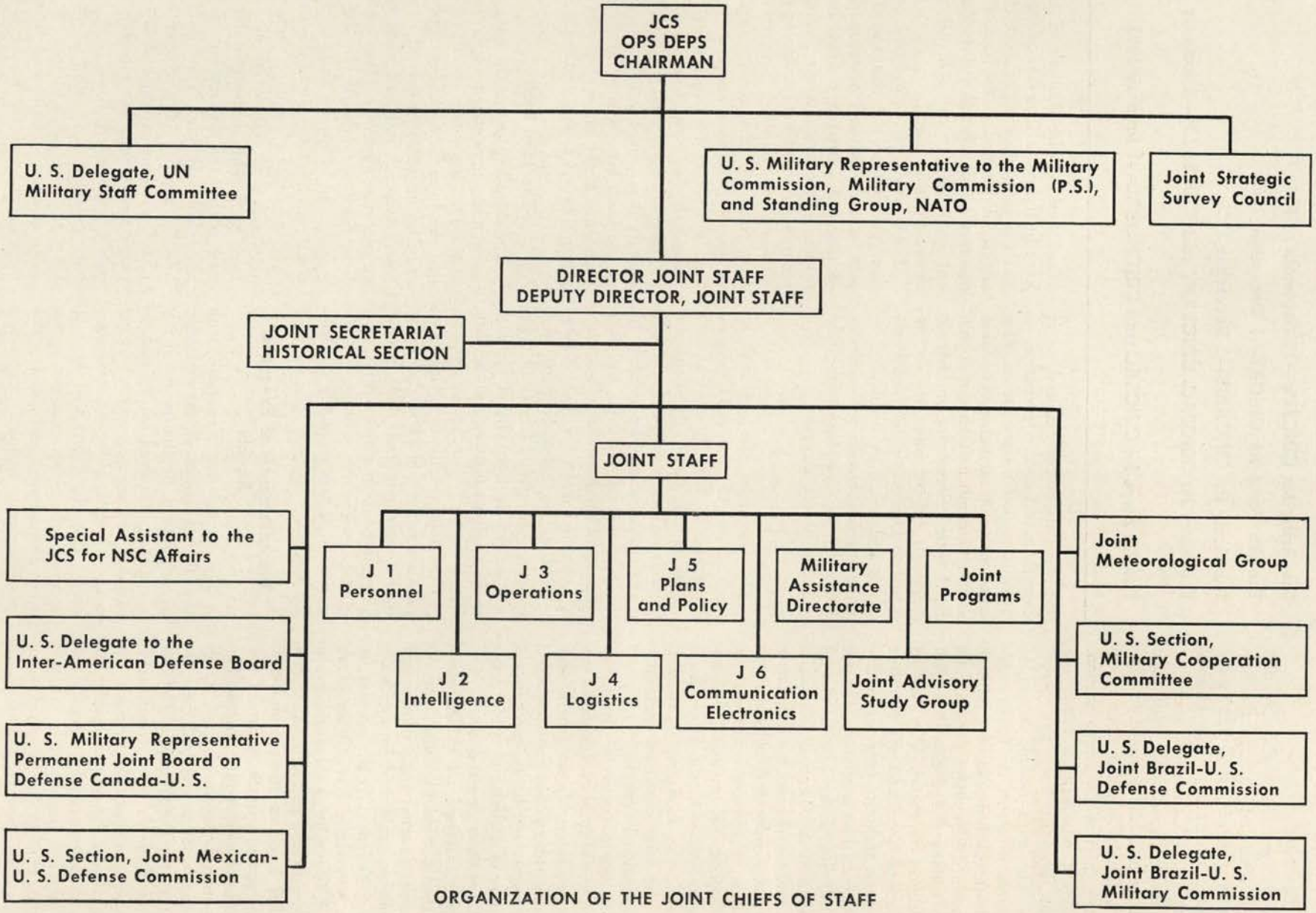
Discontinuance of Executive Agents

The second key area deals with the discontinuance of the executive agency system. Legislative action was not directly involved in this step, as the executive agency system was not covered by law. However, it was necessary that the Joint Staff be augmented before the executive agents were discontinued, and therefore the procedure was indirectly dependent upon passage of the legislation. Once the necessary augmentation was authorized (raising the strength of the Joint Staff from 210 to 400 officers), and the Joint Staff began to receive additional personnel, the executive agencies were scheduled for phase out according to the schedule as shown on this page.

There was little controversy over this provision of the reorganization plan, as such, although augmentation of the staff stirred a tempest in a teapot. There are, however, certain unanswered questions concerning the division of responsibility between the Joint Staff and the military departments. It is obvious that the Joint Staff will never be large enough to handle all the details once handled by the executive agents, and that the military departments must carry part of the load, but there is insufficient experience at the moment to provide a firm solution to this problem.

The Joint Staff

The third key area is the reorganization and augmentation of the Joint Staff. The legislation clearly states that the Joint Staff shall not operate or be organized as an over-all Armed Forces General Staff and shall have no executive authority. However, the Joint Staff is authorized to be organized and to operate along conventional staff lines. In spite of this rather clear and explicit language, there was a great deal of controversy over the Joint Staff. This controversy did not arise within the Department of Defense—although the Navy did not initially approve of a conventional J-Staff, preferring to organize a Joint Operations Group—but rather in the public press where there were loud outcries about a so-called "Prussian General Staff." Even though the authors of these outcries had little or no conception of the nature of the Prussian General Staff, they were not hindered and the uproar tended to



ORGANIZATION OF THE JOINT CHIEFS OF STAFF

foster the impression that there was a division within the Department of Defense on this matter. Actually, as I have noted, this was not the case, and once the Navy had accepted the J-Staff concept, little difficulty was encountered in arriving at the organization for the Joint Staff. I should like to point out that the limitation of 400 officers applies only to the staff proper and that the total strength of the Joint Chiefs of Staff Organization is considerably larger.

The Three Issues

Finally, we come to the controversial aspects of the legislation. These have, of course, been resolved by the Congress, but since they were so much in the public press, I think it may be of interest to trace the background of each.

Right of Appeal

The first issue concerned the right of the Service Secretaries and their respective Chiefs of Staff to appeal directly to the Congress. The Administration felt that this right was unnecessary and contrary to good organizational procedures. The House of Representatives version of the reorganization bill left this right of appeal, which incidentally has never been exercised by a Secretary of the Army or Army Chief of Staff, unchanged. The Senate bill excluded the Secretary of a Military Service, but allowed a member of the Joint Chiefs of Staff or the Joint Chiefs of Staff as a corporate body to present recommendations on the security of the United States to the Committees of Congress. The Joint Senate-House of Representatives Committee of Conference agreed that the House version should stand, so that at the present either the Secretary or the Chief of Staff is authorized to present to Congress, on his own initiative, any recommendations relating to the Department of Defense.

Military Departments Each Separately Organized

The second issue concerned the separate organization of the military departments. The old law prescribed that the services be separately administered, and the Department of Defense felt that this prevented maximum efficiency in centralizing administration, as for example under the Single Manager concept. The House changed the phrase to "separately organized" hoping to obviate this difficulty, but the Administration objected that this language still handicapped the Assistant Secretaries of Defense in the discharge of their responsibilities. The Senate, therefore, retained the phrase "separately organized" and expanded upon the authority of the Assistant Secretaries of Defense, providing that the Secretary of Defense might authorize an Assistant Secretary to issue orders to a military department, but only through the Secretary of that military department or his designee. The Conference Committee further restricted the Assistant Secretaries of Defense by providing that such authorization must be in writing and for a specific subject area.

Inter-Service Transfer of Functions

The last controversial issue concerned the transfer of functions from one service to another. The President had requested the Congress to provide the Secretary of Defense with rather sweeping powers to transfer combatant functions among the services. The House version authorized the Secretary of Defense to transfer, abolish, reassign, or consolidate all functions other than *major combatant functions*. These latter functions were to be transferred or otherwise reassigned only after the Secretary of Defense had reported his intent to Congress and a period of 60 calendar days of continuous session had passed without a concurrent Congressional resolution opposing the transfer having been made. There was, and is, no definition which would distinguish between a major and a minor combatant function, so the House provided that any function would automatically assume the stature of a major combatant function should a member of the Joint Chiefs of Staff object to its transfer. The Department of Defense felt that this was unduly restrictive and the Senate version of the law provided that no function prescribed by law could be transferred until it had been reported to the Armed Services Committees of both the Senate and the House, and 30 days of continuous session had passed without either committee reporting out a resolution against the transfer. If either committee reported a resolution against the transfer, the appropriate house of Congress then had another 40 days of continuous session in which to pass the resolution by a simple majority. Only if this was not done within the 40 days could the transfer be effected. Note that in this version, which was eventually adopted, a concurrent resolution of both houses of Congress is not required to block the transfer; either House is able to do so.

The Congress, in referring to functions established by law, was in general directing its attention to Sections 3062 (b), 5012, 5013, or 8062 (c) of Title 10 US Code, which state the broad missions of the military services.

The legislation is not as restrictive as it might seem, for in both Senate and House versions, the President is authorized to transfer any function if he deems such transfer necessary by reason of hostilities or imminent hostilities; the decision of imminence of hostilities resting entirely with him. In this event, the transfer shall remain in effect only so long as hostilities or the threat of hostilities last.

Also, in both versions, the Secretary of Defense is authorized to provide for the execution of any supply or service activity common to one or more military department by a single agency or such other organizational entities as he deems appropriate. This provision allows the Secretary of Defense flexibility in implementing such measures as the Single Manager concept.

Summary

The full impact of the Department of Defense Reorganization Act of 1958 will be determined by developments during the next few years. It is a foregone conclusion that the Reorganization Act will improve the effectiveness of the Department of Defense. It clearly emphasizes the joint structure, both at the governmental level and in the field. The Secretary of Defense has more authority than ever before, the Joint Chiefs of Staff Organization has been given greater responsibilities and the stature of the commanders of the unified and specified commands has been increased. The reorganization was supported by the Army and much effort must be made to insure its success.

(U. S. Army)

A "Five Point Program" for . . .

Improving Our Capabilities for Limited War

By GENERAL MAXWELL D. TAYLOR

Although we now have a significant capability to cope with limited wars, we can and should take steps to improve it. So then the question becomes: "What should we do about it? What are these steps?"

My view is that we should embark on a "Five Point Program" to improve the capabilities of the Army and our Sister Services to meet the possible challenges posed by limited war. The salient points of this program are:

1. The modernization of appropriate equipment.
2. The improved strategic mobility of limited war forces.
3. The preplanned use of air and sealift.
4. Expanded joint planning and training.
5. The publicizing of our limited war strength.

In speaking before the National Convention of the American Legion last September, the Secretary of Defense stated:

> Our Army has been undergoing a modernization program designed to prepare it for the stepped-up requirements of today's or tomorrow's possible war, not yesterday's. . . . This modernization program is by no means complete. We intend to push it vigorously.

In pursuance of Mr. McElroy's injunction, the Army intends to push its modernization along the following line:

Modernization

Dollar-wise, our problem is not a simple one. Approximately 60 percent of the dollar value of the Army's

This article was extracted from a speech given by General Taylor at the 35th Annual Session of the Institute of World Affairs in Pasadena, California. It actually is the concluding portion of his speech and should serve as a basis for the Army's needs for the immediate foreseeable future.

inventory of equipment was procured during World War II or the Korean War; 10 percent of it is of pre-World War II vintage. As a result, many items have reached a point where they are no longer economical to maintain or are incapable of meeting "the stepped-up requirements of today's or tomorrow's possible war." As a result we need to include second generation missiles, light atomic weapons, improved conventional weapons and many new types of air and ground vehicles to advance tactical mobility. To direct and control our units and weapons we require improved, lightweight signal communications based upon newly designed radio equipment.

Improved Strategic Mobility

The modernization of our forces will tend to support our second point; improved strategic mobility. As the Army lightens its loads, we hope that our Sister Services will modernize the sea and airlift upon which we depend for our strategic mobility.

As a part of our program to improve strategic mobility, we need to determine the logistical bottlenecks to mobility about the world and endeavor to eliminate them. These can often be minimized by the forward stockage of supplies and equipment in critical strategic areas, to reduce the tonnages which must be transported in an emergency.

Preplanned Use of Air and Sealift

The third of our five points is the preplanning of the contingent use of a certain amount of air and sealift for possible limited war requirements. At present, the Army has no indications of the lift which would move its spearhead forces in an emergency. Some predesignation of air and sea elements for plannning purposes would materially shorten the time required to get the initial forces on their way. The actual lift would not be released for use without the specific approval of the Joint Chiefs of Staff.

I do not suggest that such preplanning should cause a certain number of planes or ships to stand idle, marked "For Army Use Only." That makes no sense to me. However, it would make a great deal of sense if the Army knew in advance that in an emergency, a given amount of lift would be available at designated airfields and ports ready for movement on JCS approval. This knowledge would contribute materially to realistic planning for the rapid reaction of our spearhead units to limited war situations. I should add that the possibility of effective coordination of such preplanning will be facilitated by the new Joint Staff authorized by the recent reorganization act of the Department of Defense.

Expanded Joint Planning and Training

In this phase of Defense reorganization I would like to say that, in my judgment, this legislation and its implementation now in progress, represent a major step forward in the achievement of an organization better able to deal with the military exigencies of today and the future. One important use of the new Joint Staff should be directed toward the accomplishment of the fourth point of the Limited War Program; namely, expanded joint planning and training for limited war. Such joint action might include the checking and testing of plans for overseas movement of forces, the verification of their readiness, and the actual movement of token forces as training for emergency situations. I should like to feel that we are as effective in meeting the complex requirements of limited war as SAC is in meeting the requirements of general atomic war. I think SAC is a most impressive military organization. Its complete dedication to readiness in its particular field is most impressive. I should like to find a similar intentness on the limited war problem.

Publicizing Our Strength

The final point of the five-point program is to make clear to the world our readiness to react adequately anywhere to the challenge of aggression. To many observing America from a distance, we appear to be a country prepared to fight in case a general war should be forced upon us, but with unknown resources for a lesser response. It is highly important for psychological reasons to publicize our capabilities to react with weapons and means short of those associated with massive retaliation. This evidence of readiness could be attained through exercising and testing our limited war forces. Illustrative of what I have in mind was a small operation on a limited scale about three years ago in Thailand. We sent a joint airborne, seaborne task force into this area for the purposes I have described. The Army furnished an HONEST JOHN rocket unit from Japan, a Marine unit and Navy ships participated, as did planes of the Tactical Air Command. The task force was assembled in Bangkok in about 48 hours. This exercise made a very significant impression in Southeast Asia as a token demonstration of the reaction capability of American forces in that area.

Conclusion

In conclusion, I would stress again that I am not preaching a purely Army program. All Services would be involved in this five-pronged effort to improve our effectiveness in limited war. It is an essential extension of our national policy. We must overcome any impression that we are a country which can respond with a big bomb and little else. Although we have significant assets now to cope with limited wars, these can and must be improved so that it can be made crystal clear to both our friends and foes that we can respond promptly with proper weapons and proper forces to any challenge. It is the purpose of the Army to develop its strength in such a way that it may play its indispensable part in presenting this flexible military capability to the world.

Reconnoitering

As has been our annual custom for the past several years we again devote the *Reconnoitering* pages to a roundup of the past year's activities as applicable to our Army, our Branch and our Association.

With the passing of another twelve-month period and the celebration of the 182d Anniversary of our branch on the 12th of December, it is desirable to look in retrospect at what has transpired.

The 182d Anniversary was celebrated by many groups of armored personnel stationed around the world. Likewise it was noted by greetings from The Secretary of the Army, The Honorable Wilber M. Brucker, and our eminent Chief of Staff, General Maxwell D. Taylor. We are pleased to publish these greetings so that all members can note the interest taken in our branch by the two top people in our Service.

The 70th anniversary of the publishing of our journal passed in March. This was featured in the March-April issue of *ARMOR* with the publishing of an outstanding article authored by the preceding editor. In it he took us back through the years highlighting the Association's colorful history.

During the winter months the 2d and 4th Armored Divisions completed their Gyroscope moves between Fort Hood and Germany. In the Spring we had the privilege of bidding farewell to the 2d Armored Cavalry Regiment which replaced the 3d Armored Cavalry Regiment along the German Border. We greeted the 3d Cavalry Regiment shortly after they arrived at Fort Meade. This was the second rotation for these two units.

New equipment included the tank helmet for tank crewmen and an electronic earphone to eliminate much of the noise for tank crewmen. Although not considered major items of armor equipment these two items will greatly increase the efficiency of the members of the tank crew.

Our 69th Annual Meeting, held at Fort Knox, was a huge success. General Taylor delivered the principal address. We were also honored by the presence of the Chairman of the Joint Chiefs of Staff, General Nathan F. Twining, who participated in some of the activities. Lieutenant General George W. Read, Jr., Commanding General, Second U. S. Army, succeeded General Willard G. Wyman to the Association Presidency. General Read thus becomes our 18th president since the formation of the Association in 1885.

Representatives of the Association participated in the tribute to the two unknowns from World War II and Korea on Memorial Day.

With the graduation of the Armored Officers' Advance Class in June at Fort Knox, Marine Captain Robert W. Howland was the winner of this year's Association award, a Revere silver bowl. For the benefit of the students of the current class we intend to again give this award to the top graduate this coming June.

Many retirements occurred during the year. Worthy of mention is General Wyman who was replaced as USCONARC Commanding General by General Bruce C. Clarke. Lieutenant General Collier, our 15th President, retired as did Major General William M. Stokes, Jr., our present vice-president representing the Army Reserve. A longtime council member and Association officer, Major General Albert S. Johnson, Commanding General of the 49th Armored Division, retired and was succeeded by Brigadier General Clayton P. Kerr. Likewise, Major General Maxwell C. Snyder assumed command of the 48th Armored Division upon the retirement of Major General Patrick E. Seawright.

A meeting of the Executive Council of the Association was held on the 3d of December. Tentative plans for the 70th Annual Meeting were made at this time. The place, once again, is the home of Armor, Fort Knox. As soon as the program is known and the principal speaker has accepted our invitation the dates will be announced to all members.

As we close this issue for press, word has been received that the winning platoon for the coveted Draper trophy is the 2d Platoon, Company D, 32d Armor of the 3d Armored Division. The Platoon Leader is Lieutenant Richard S. Lovelace and the Platoon Sergeant is Master Sergeant Tyler B. Adams.

Subject to Department of the Army approval our six National Guard Armored Divisions are expected to reorganize under ROCAD during this coming calendar year. Modernization of other Reserve component units is also anticipated in the near future.

All in all it has been an eventful year. Looking ahead we intend to bend every effort, as an Association, to continue to contribute to the professional improvement of the Army, the branch and the association membership.

The Editor

SECRETARY OF THE ARMY
WASHINGTON

TO THE ARMOR OFFICERS AND MEN
OF THE UNITED STATES ARMY

On the occasion of the 182nd Anniversary of Armor, I take considerable pleasure in sending heartiest congratulations to the members of this powerful and mobile arm.

You can be justifiably proud of the part Armor has played--and continues to play--in defending our Nation. Its indispensable role during times of struggle has immeasurably aided us to attain our victories. Its great mobility and fire power are constant reminders of its state of readiness and aid us largely in averting war. Indeed, throughout Armor's long and distinguished history it has, by its sheer devotion and esprit de corps, not only increased the prestige of its combat arm, but also has made an enviable and vital contribution to our great Nation's Defense Team.

As Armor vigorously approaches its bicentennial, I am confident that you will continue to prosper and to carry on in the tradition for which Armor is famous.

Wilber M. Brucker

Wilber M. Brucker

UNITED STATES ARMY
THE CHIEF OF STAFF

TO THE OFFICERS AND MEN OF ARMOR

On behalf of the United States Army, I extend congratulations and best wishes to the members of Armor on the occasion of its 182d anniversary.

Armor's traditions and esprit were shaped and forged in the wars of our early history and tempered on the battlefields of the major wars of this century. From saber, carbine, and horse, to the modern tank with its integrated supporting arms, Armor has demonstrated its adaptability and flexibility as a powerful arm of mobile warfare. Its characteristic ability to move, shoot, and communicate in mounted combat will give a decisive element to the battlefields of the future. Today, Armor's strength and distinctive capabilities are a significant contribution to the Army's war-deterrent role in furtherance of the Nation's security.

Yours is the honor and privilege of membership in a distinguished combat element of the Army team, the other members of which join with me in expressing pride in your past exploits and confidence in your ability to meet the challenge of the future.

Maxwell D. Taylor

MAXWELL D. TAYLOR
General, United States Army
Chief of Staff

(All photos U. S. Army)

Steps in the Right Direction

By CAPTAIN RICHARD E. O'BRIEN

WITH the advent of the internal-combustion engine as the means of propelling combat vehicles, fuel supply in the Army became a major logistical problem. Since World War I this problem has increased in magnitude. This has been the result of an ever-increasing number of vehicles in military units and in many instances an increased fuel consumption rate by these vehicles. During World War II Allied and Axis armies alike were constantly plagued with the inadequacy or lack of fuel. At El Alamein, Rommel's defeat was assured when desperately needed fuel was lost through the sinking of Axis tankers in the Mediterranean by British naval units. During the German Ardennes offensive of 1944, lack of fuel as well as rapid Allied counteractions brought about the defeat of this last major German offense. In fact, the farthest westward advance of German forces came to a halt when the lead panzer battalion ran out of fuel just four miles east of the Meuse River. Allied armies also had their fuel difficulties. During the fluid operations following the breakout at St. Lo, it soon became apparent that the supply system could not keep pace with supply requirements. After a few weeks the supply system reached the breaking point and operations had to be slowed down. Patton's Third Army tried to alleviate the problem by employing aerial resupply. Tons of fuel and other supplies were flown in, but even with air superiority this system could not maintain the Allied offensive. Once again, the old bugaboo, *lack of fuel,* slowed down and finally stopped a modern army. Since World War II, fuel requirements for the armored division have increased considerably. In World War II it took 146,000 gallons of gasoline to move an armored division 100 miles on roads; the 17R division, organized after the war, required 226,000 gallons; and the newly adopted ROCAD division requires 215,000 gallons. These increases are attributed to heavier equipment and correspondingly larger internal-combustion engines. In the current armored division, excessive fuel consumption can be attributed to the M48 tank. This tank will be replaced in the near future by the M48A2, which incorporates a fuel injection system and a fuel tank with an increased capacity. These major modifications will increase the range of the medium-gun tank by a reduction in fuel consumption and the increased fuel tank capacity.

For the purpose of this discussion let us leave the fuel consuming vehicle and move to the other end of the fuel problem spectrum, the problem of getting fuel to the vehicle. To help alleviate the fuel supply problem a bulk supply and refueling concept is being incorporated in the Army's supply system. As a result of equipment development and troop tests by Seventh U. S. Army in Europe and staff studies by the Quartermaster General,

CAPTAIN RICHARD E. O'BRIEN, Armor, served in Europe during World War II with the 101st Airborne Division. Enlisting in 1943 he received an OCS commission in 1949. After attending the Basic course at Knox, he went on competitive tour obtaining his Regular Commission. Next he served in the 45th Reconnaissance Battalion in the Caribbean. Returning Stateside he served in the 30th Tank Battalion at Fort Knox and attended the Advance Course. Remaining there as an instructor in Logistics for three years he is now the S2 of the 2d Medium Tank Battalion in Korea.

The U. S. Army Armor School and The U. S. Army Infantry School, bulk fuel handling equipment was included in the ROCAD TOE. The first test of bulk fuel handling equipment in the armored division was conducted in the spring of 1957 by the 1st Armored Division during Exercise SLEDGE HAMMER. Further testing of this concept was accomplished during Exercise STRONGARM, which was conducted in early May of this year in the Louisiana maneuver area.

Bulk Fuel Handling Equipment

Development of bulk fuel handling equipment during the past two years has resulted in improved rigid pipeline and tank farm components, testing of an assault pipeline system, and the development of a series of gasoline dispensing kits that can be mounted on either the 2½-ton or 5-ton cargo truck. In July 1957, a conference was held at the Quartermaster Research and Engineering Command, Natick, Massachusetts, on bulk fuel equipment. Responsible and interested agencies from Headquarters, U. S. Continental Army Command, Quartermaster Corps; Transportation Corps and The U. S. Army Armor School attended. Conclusions arrived at during the conference included:

1. Immediate standardization of a dispensing kit incorporating:
   a. Two 600-gallon aluminum tanks.
   b. Rear-mounted, 50-GPM, gasoline engine driven pump.
   c. Two hoses, 50 to 100 feet long, two hose retracting reels and automatic shutoff nozzles.
   d. Meter, filter and water separator (optional equipment).
   e. All components of the dispensing kit to be mounted within the bed of a 2½-ton or 5-ton cargo truck.
2. Future development objectives:
   a. Fuel tank, collapsible cell, approximately 600-gallon capacity. Cell to be compatible with the cargo space and lift capability of the 2½-ton and 5-ton cargo trucks and lift capability of cargo helicopters (external load).
   b. Dispenser. Power take-off or electric drive.
   c. Accessories. Two or more hoses, 50-100 feet long, metering device and automatic shutoff nozzles.
   d. Armored, full-track, bulk refueling vehicle.

Bulk fuel handling equipment included in the ROCAD TOE are the 5,000-gallon and 1,200-gallon tank trucks. Detailed allocation of these vehicles and fuel carrying capabilities of ROCAD units are shown in *figure 1*. Detailed descriptions to include pictures of major items of bulk fuel handling equipment that is found in the field army as well as those items organic to the armored division are found on pages 28 through 31. The sequence of the photographs generally follows the logical location of this type of equipment, starting with a petroleum tank farm and ending with the refueling of tactical units. The sequence of photographs (numbers one to 12) is also compatible with the sketch of a "Flexible Bulk Fuel Supply System." (See pages 32 and 33.)

TOE CHANGES IN FUEL-HANDLING EQUIPMENT

UNIT	17T ROCAD				17R			
TOE Title	1200-gal Tkr (ea)	5000-gal Tkr (ea)	5-gal* cans (ea)	Unit Class III Re-supply**	1200-gal Tkr (ea)	5000-gal Tkr (ea)	5-gal* Cans (ea)	Unit Class III Re-supply**
Armor Bn (ea)	8	0	2,477	21,985	0	0	2,142	10,710
Armd Inf Bn (ea)	4	0	1,293	11,265	0	0	996	4,980
Armd Cav Sq (ea)	8	0	2,553	22,364	0	0	1,009	5,045
Avn Co (ea)	4	0	0	4,800	-	-	---	---
Armd Fld Arty Bn (ea)	2	0	638	5,590	0	0	756	3,780
Armd Engr Bn (ea)	3	0	65	3,925	0	0	280	1,400
Armd QM Bn (ea)	5	18	3,087	111,435	0	0	6,010	30,050
Total Div	76	18	23,337	297,885	0	0	22,875	114,375

* Does not include 5-gallon cans for OVM, ranges, tent stoves, or other administrative purposes.

** Gallons.

Figure 1.

1. This tank farm (rigid tanks) consists of steel tanks, inlet and outlet lines, manifolds and gauges. The installation is normally located in the communications zone but may be located within the field army. This one consists of one 10,000-barrel (430,000-gallon), one 2,000-barrel (84,000-gallon) and one 1,000-barrel (42,000-gallon) rigid tanks. The six-inch rigid pipeline can carry 630,000 gallons of gasoline per day based on a 20-hour operating day. This is standard engineer equipment and was used in World War II, Korea and the European Theater.

2. The assault pipeline is used to extend the rigid pipeline system into the forward area and may, when feasible, be extended into a division rear area. It consists of 500-foot lengths of 4-inch collapsible hose, booster pumps and manifolds. The hose operates at pressures up to 150 PSI. Two sections coupled together to make a length of 1,000-feet are packed in a flaking box. Five flaking boxes can ve transported on a 2½-ton truck, and by coupling the ends of the hoses together, 5,000-feet of hose can be laid without a halt. The recommended rate for flaking out hose is from 10 to 15 MPH. Booster pumps are installed every 10,000-feet. This photo shows the start of a flaking operation.

3. Tank farm (Marine Corps-type collapsible tanks). This type of tank farm consists of 10,000-gallon collapsible tanks, inlet and outlet lines, manifolds and gauges. The photo shows this type of tank farm consisting of six 10,000-gallon collapsible tanks. This installation may be found at the forward terminus of a rigid or assault pipeline system and can serve as an army class III supply point.

4. 5,000-gallon tank truck. This vehicle consists of a 12-ton, 4-wheel (5,000-gallon), M131 gasoline tank semitrailer towed by a 5-ton, 6 x 6 M62 tractor truck. It has a rated payload of 5,000 gallons over prepared roads, and 3,000 gallons over all types of roads, trails and limited cross-country operations. The trailer is equipped with a 250-GPM dispensing unit. It can be filled in 20 minutes at an expenditure of ⅔ man-hour (2 men, 20 minutes). To load the same amount of package fuel would require 16 man-hours (4 men, 1 hour) for each of four 5-ton trucks.

5. Division forward class III distributing point. The armored division is responsible for delivering class III supplies to subordinate units. This is accomplished by the establishment of a forward class III distributing point in each combat command trains area. The photo shows battalion 1,200-gallon tank trucks being filled by division 5,000-gallon tank trucks.

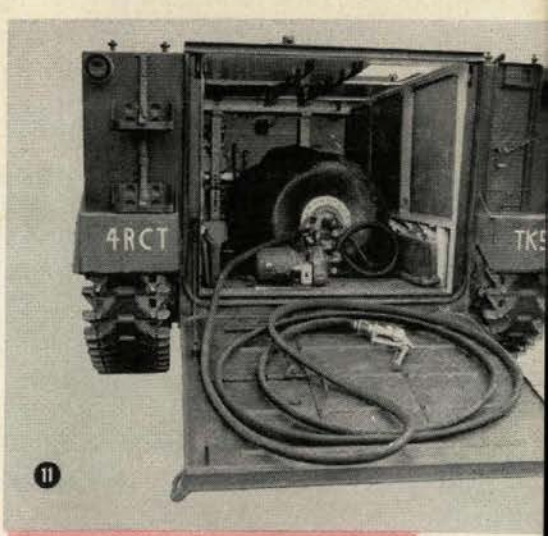
6. 1,200-gallon tank truck M49. The M49 is a special purpose standard issue vehicle and therefore limited to one-way payloads. The vehicle has the same mobility as the standard 2½-ton truck. It can be filled from a 5,000-gallon tank truck in 10 minutes at an expenditure of ⅓ man-hour (2 men, 10 minutes). To load the same amount of package fuel would require 4 man-hours (4 men, 1 hour).

7. Experimental refueling kit (1200-gallon). This kit is being issued as a substitute item for the M49 tank truck. It is used to convert a general purpose, 2½-ton, M211 cargo truck to serve as a bulk fuel transporter and dispenser. The kit consists of two 600-gallon welded tanks, a gasoline-engine-driven 50-gallon-per-minute centrifugal pump, necessary piping, and two 50-foot hoses equipped with 25-gallon-per-minute nozzles. The tanks are mounted on bed of the truck, the dispensing pump on the front bumper.

8. Experimental refueling kit (1200-gallon, Kuss-type). This kit is an improved version of the above kit. This kit is also mounted on the general 2½-ton M211 cargo truck. The kit consists of two 600-gallon welded steel or aluminum tanks, a gasoline-engine-driven 50-gallon-per minute centrifugal pump, a water separator, a metering device, necessary piping, and two 50-foot hoses equipped with 25-gallon-per-minute nozzles. The tanks with the dispensing assembly are mounted on the bed of the truck. Tests conducted during Exercise SLEDGE HAMMER indicated this kit to be much more satisfactory than the above model (bumper-mounted dispenser.

9. Experimental refueling kit (525-gallon, Sealdbins). This kit consists of two 525-gallon collapsible containers (Sealdbins) and a dispensing assembly mounted on the bed of a 2½-ton cargo truck. When emptied, the Sealdbin can be collapsed to approximately 25 percent of its size when filled. This space saving of 75 percent can be utilized to transport personnel, material or supplies to the rear.

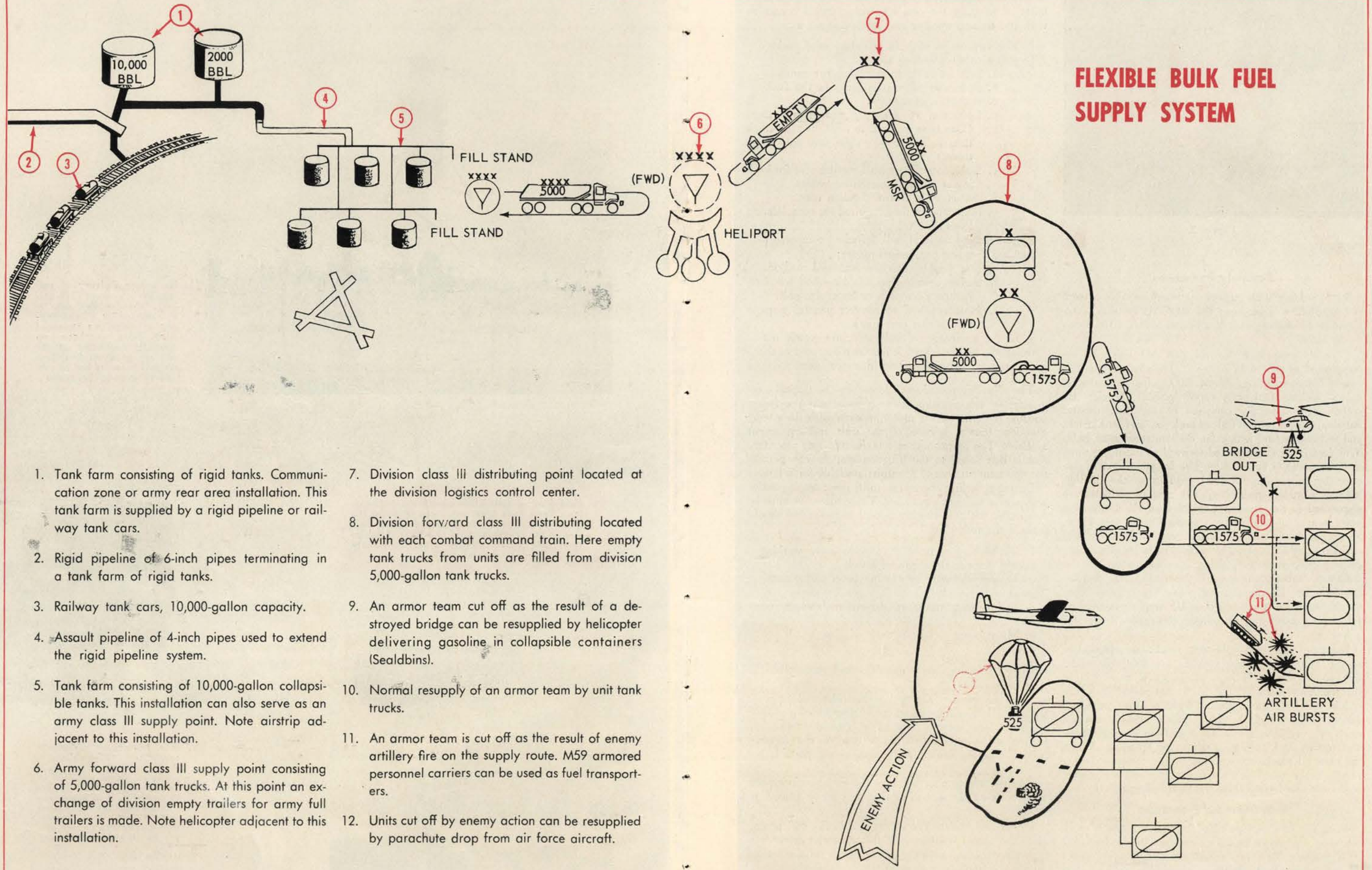
10. Helicopter delivery of collapsible containers (525-gallon). The Sealdbin can be transported by a light helicopter using an external sling. Tests have been successfully conducted on the delivery of filled Sealdbins directly into the bed of cargo vehicles by helicopter.



11. M59 delivery of collapsible container (525-gallon). A Sealdbin with an electric pump is shown mounted in an M59 APC. Whenever terrain conditions or enemy action prevents the use of thin-skin wheeled tank trucks, this system can be put into use on an emergency basis.

12. Para-drop of collapsible containers (525-gallon). Tests have been completed in which the Sealdbin was successfully para-dropped. This step in the development of this item of equipment adds to its flexibility of use in resupply operations.

FLEXIBLE BULK FUEL SUPPLY SYSTEM



1. Tank farm consisting of rigid tanks. Communication zone or army rear area installation. This tank farm is supplied by a rigid pipeline or railway tank cars.
2. Rigid pipeline of 6-inch pipes terminating in a tank farm of rigid tanks.
3. Railway tank cars, 10,000-gallon capacity.
4. Assault pipeline of 4-inch pipes used to extend the rigid pipeline system.
5. Tank farm consisting of 10,000-gallon collapsible tanks. This installation can also serve as an army class III supply point. Note airstrip adjacent to this installation.
6. Army forward class III supply point consisting of 5,000-gallon tank trucks. At this point an exchange of division empty trailers for army full trailers is made. Note helicopter adjacent to this installation.
7. Division class III distributing point located at the division logistics control center.
8. Division forward class III distributing located with each combat command train. Here empty tank trucks from units are filled from division 5,000-gallon tank trucks.
9. An armor team cut off as the result of a destroyed bridge can be resupplied by helicopter delivering gasoline in collapsible containers (Sealdbins).
10. Normal resupply of an armor team by unit tank trucks.
11. An armor team is cut off as the result of enemy artillery fire on the supply route. M59 armored personnel carriers can be used as fuel transporters.
12. Units cut off by enemy action can be resupplied by parachute drop from air force aircraft.

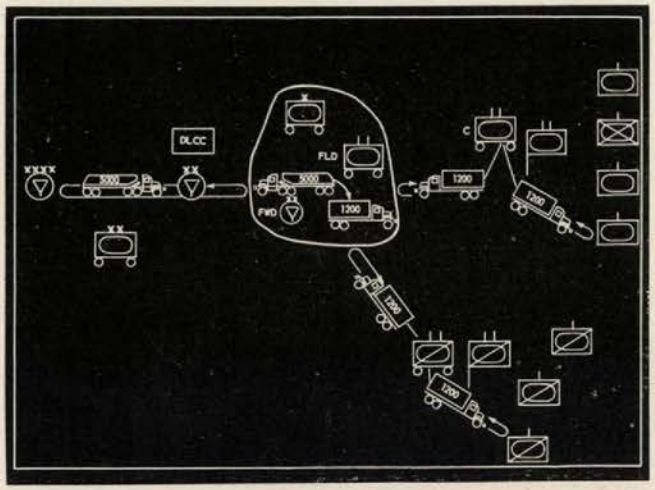


Figure 2.

Resupply Procedures

In accordance with current approved concepts in supply distribution procedures the ROCAD division is responsible for making unit distribution of class III supplies to the units.

Class III resupply within the ROCAD division is accomplished as shown in *figure* 2. The division quartermaster battalion, using organic 5,000-gallon tank trucks, draws gasoline from army supply points. The class III section of the supply company of the quartermaster battalion is equipped to unload tank cars and tank trucks and to package fuel which the division receives in bulk. This fuel is then transported forward to the using units in cargo trucks or tank trucks. The battalion receives gasoline by submitting informal requests to the division logistics control center. Required gasoline vehicles are dispatched to the division forward class III distributing point located in each combat command trains area. Here, an exchange of loads is effected between battalion and division gasoline trucks. The tactical situation permitting, division tank trucks may deliver gasoline forward to the battalion combat trains area. As the trucks of the division forward class III distributing points are emptied, they are dispatched to the army class III supply point for refill or for exchange of an empty 5,000-gallon trailer for a full one.

Battalion fuel and lubricant trucks are dispatched to the companies, where supplies are delivered to the individual vehicles. If it is not practical to deliver to the individual vehicles, the trucks are placed in a central location and the supplies (5-gallon cans) are hand-carried to the vehicle by the vehicle crews; or, as a last resort, the vehicles are withdrawn from their positions and moved back to this location for refueling. When the class III trucks are emptied by the companies, they return to the battalion field trains area and are refilled at the division forward class III distributing point.

Bulk Refueling Procedures

With the flexibility provided by the inclusion of bulk refueling equipment and 5-gallon cans in the ROCAD TOE it is possible to accomplish efficient refueling under all conditions. Bulk refueling should be accomplished whenever practicable. The commander now has the capability of selecting the best refueling method consistent with the terrain, weather and tactical situation.

1. The advantages of bulk refueling over package (5-gallon cans) refueling are:
   a. Less fatiguing to refueling personnel.
   b. Reduction of contaminants in the fuel.
   c. Reduction of wastage.
   d. Reduction of resupply turn-around time. (Less time required to refill the tank truck than to load 5-gallon gas cans into cargo truck.)
   e. Reduction of personnel requirement for loading at division distributing points.
   f. Reduction in loss of 5-gallon cans.
   g. Reduction in time required for consolidating loads after refueling.
2. The disadvantages of bulk refueling compared to package (5-gallon can) refueling are:
   a. Less flexible than the packaged method.
   b. Slower than the packaged method when refueling a company or larger-size unit.
   c. Time required to convert general purpose vehicle to a tank truck.
3. As the advantages of bulk refueling greatly outweigh the disadvantages, it has been accepted as the primary method of refueling in armor units.

The refueling procedures adopted by the tactical commander in any situation have as their goal the fastest possible refueling of the unit consistent with the enemy situation, terrain, mission of the unit and equipment available. The commander selects the refueling procedure that is best suited to the situation and thereby permits the optimum number of fire units available for action.

During refueling operations, units must employ active and passive defensive measures. These measures must be compatible with the existing tactical situation and should include the following:

1. Establishing security to provide early warning against surprise air or ground attack.
2. Taking advantage of existing cover and concealment.
3. Maintaining maximum dispersion between vehicles.
4. Maintaining a constant state of alert by all personnel.

During refueling, crew members will accomplish the following:

Tank commander. The tank commander will supervise the over-all refueling operation. This includes providing necessary local security (for air or ground attack), enforcing safety precautions, inspection of the external condition of the vehicle and manning the portable fire extinguisher.

Gunner. The gunner will man the antiaircraft weapon and be constantly alert to repel enemy air or ground attack.

Driver and loader. The driver and loader will accomplish the actual refueling. At this time the driver will report any unusual noises or actions of the vehicle noticed during the previous movement.

There are basically two procedures for refueling vehicles by tank trucks. These are moving the tank truck to the vehicles or moving the vehicles to the tank trucks. From these two procedures stem many variations limited only by the ingenuity of the commander. The advantages and disadvantages of one procedure *versus* the other procedure are as follows:

1. Moving the tank truck to the vehicles.
   a. Advantages.
      - Increased time for maintenance.
      - Reduced fatigue for vehicle crew members.
      - Minimum movement of combat vehicles.
      - Maximum number of fire units available for action.
   b. Disadvantages.
      - Increased fatigue for refueling personnel.
      - Tank trucks limitations (cross-country mobility).
      - More vulnerable in forward areas.
      - Increased time required to refuel company-size or larger units.
2. Moving the vehicle to the tank truck.
   a. Advantages.
      - Reduced fatigue for refueling personnel.
      - More suitable for tank truck operations.
      - Less vulnerable in forward areas.
   b. Disadvantages.
      - Reduced time for maintenance.
      - Increased fatigue for vehicle crew members.
      - Increased movement of combat vehicles.
      - Reduced number of fire units available for action (on an objective).

Shown in *figures* 3 and 4 are procedures for refueling a tank company on a road march and in an assembly area. These represent only two of many different procedures that may be developed by local commanders.

Refueling a tank company on a road march. (*See figure* 3). Except for local security, refueling on a road march can be considered as an administrative operation. Direct enemy interference will normally be limited to enemy air actions or long-range artillery fires. Because of these conditions all units must take maximum advantage of passive defensive measures during refueling. Maximum dispersion must be maintained between vehicles and maximum advantage must be taken of available concealment.

In *figure* 3, tank trucks attached to a tank company precede the company and set up a *service station* at a preselected point along the route of march. The area selected for the service station should be large enough to permit maximum dispersion of vehicles; be located on the right-hand side of the road; provide hard standing, cover, concealment and multiple exits and entrances.

A point approximately 2,000 yards beyond the service station and on the route of march is selected upon which to form the column. As the first vehicle is refueled, it moves to this point, and subsequent refueled vehicles form in column at 100-yard intervals. The distance between the selected point and the service stations should be sufficient to provide a 100-yard interval between vehicles.

As the company reaches the service station, vehicles pull in and halt for refueling at one of the tank trucks. The maintenance section doubles the column and proceeds to the preselected point 2,000 yards beyond the service station. From this point the maintenance section will move toward the end of the column and accomplish any necessary repairs. As each vehicle is refueled (oil added if necessary) it reassembles in march formation.

Using the service station method, two tank trucks can refuel a tank company in 30 minutes. An armor battalion marching on one route and using eight tank trucks to set up a service station can refuel a tank company in ten minutes.

Advantages and disadvantages of this procedure are as follows:

1. Advantages.
   a. Minimum time for refueling individual vehicles.
   b. Reduced vulnerability.
   c. Reduced fire hazard.
   d. Minimum movement of tank truck.
   e. Reduced fatigue of refueling personnel.
   f. Route of march remains open.
   g. Optimum number of fire units available for action.

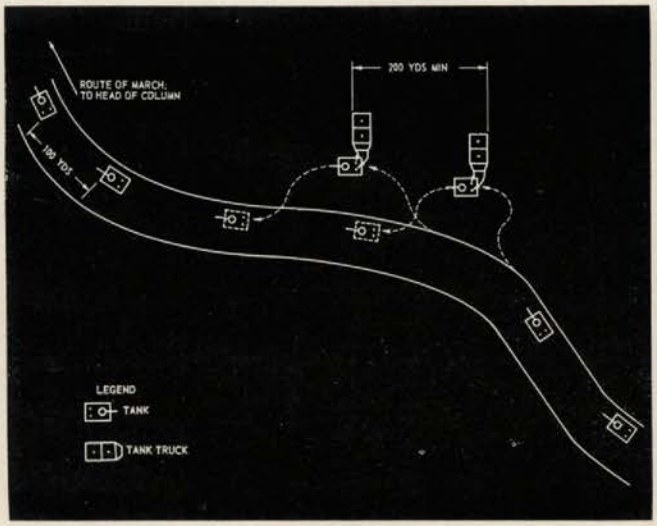


Figure 3.

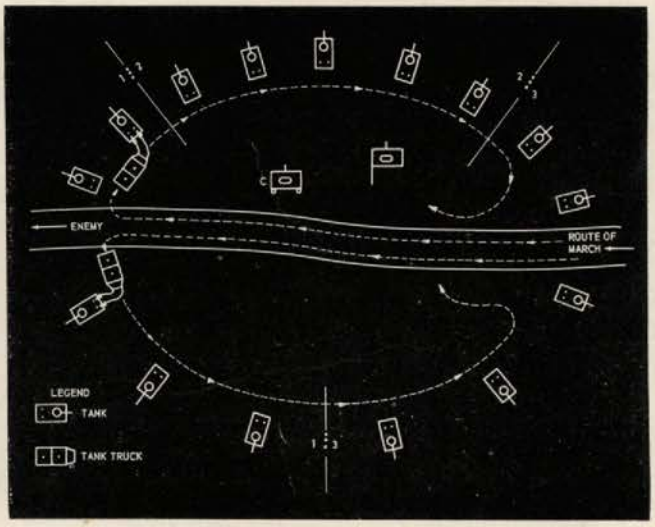


Figure 4.

2. Disadvantages.
   a. Reduced time for at-the-halt maintenance.
   b. Requires area to set up service station.
   c. Continues noise during refueling operation.

Refueling a tank company in an assembly area. (See figure 4.) During refueling in an assembly area the commander must consider enemy interference by long-range artillery fire or air attack, the proximity of enemy ground forces, dispositions of friendly forces, terrain conditions and the physical limitations of refueling vehicles.

Tank trucks attached to the tank company march at the rear of the column. When the company arrives and occupies the assembly area the tank trucks proceed to that sector of the perimeter closest to the enemy. One truck moves to the right around the perimeter, and the other to the left, stopping and refueling each vehicle in position. When all platoons have been refueled, the tank trucks move to the company command post and refuel vehicles in that area.

Advantages and disadvantages of this procedure are as follows:

1. Advantages.
   a. Combat vehicles remain in position.
   b. Minimum noise and movement by vehicles.
   c. Reduced fatigue by combat vehicle crew members.
   d. Increased maintenance time.
   e. Reduced fire hazard.
   f. Optimum number of fire units available for action.
2. Disadvantages.
   a. Increased fatigue for refueling personnel.
   b. Tank truck limitations to negotiate difficult terrain.
   c. Maximum movement of tank truck.

Advantages of Bulk Fuel Handling Equipment

Now that we have discussed the bulk equipment being used, the fuel resupply procedures employed and refueling procedures that can be used, let us consider what all this means to the armored division. The following advantages are the direct results of the employment of bulk fuel handling equipment and the incorporation of a unit supply distribution system in the ROCAD division:

1. *Saving in man-hours.* Using bulk fuel instead of package fuel results in a savings of 16 man-hours each time a 5,000-gallon tank truck is filled at an army supply point and 4 man-hours each time a 1,200 gallon tank truck is filled at a division distributing point.

2. *Saving in equipment.* This is accomplished through the reduced loss of 5-gallon cans. A 600-gallon tank is considerably more difficult to lose than is a 5-gallon can.

3. *Pure fuel.* Bulk fuel handling equipment provides the user with a more pure fuel through the reduction of foreign matters such as water, dirt and rust. The end result being improved engine performance and a reduced deadline rate.

4. *Flexibility in refueling operations.* With a bulk-refueling capability as well as a can-refueling capability the commander is able to select the method best suited for the existing situation.

5. *Reduction in supply turn-around time.* The establishment of a division forward class III distributing point in each combat command trains area reduces the turn-around time of unit resupply vehicles and thereby increases the range of tactical units. *For every 15 miles a division distributing point is displaced forward, two hours is saved by unit resupply vehicles.*

Where Do We Go from Here?

There is little doubt that the fuel handling equipment (bulk and package) provided in the ROCAD TOE, and described herein, is far superior to the equipment (package only) provided in the 17R TOE. However, this represents only one step in the right direction toward solving Armor's age-old problem of fuel supply. Armor cannot afford to rest on the laurels of this progress and be satisfied with the correction of equipment deficiencies noted during field exercises. Instead, continued emphasis must be placed upon the development of vehicles with lower fuel consumption rates, improved fuels on weight-to-performance ratio and improved means for delivering fuel to the using vehicle. These problems will have to be solved through the combined efforts of Ordnance and Quartermaster based on requirements generated by Armor. The problem of developing vehicles with lower consumption rates and fuels with an improved weight-to-performance ratio is constantly being studied. Many significant break-throughs have been accomplished in this area and the future holds great promise. The problem of improved means of delivering fuel to the using vehicles has been greatly reduced during the past year. In 1957, the following were accomplished:

1. Bulk fuel handling equipment was included in ROCAD TOE.

2. Extensive bulk fuel handling tests were accomplished.

3. The collapsible container (Sealdbins) was introduced and proved to be a very flexible bulk fuel handling item of equipment.

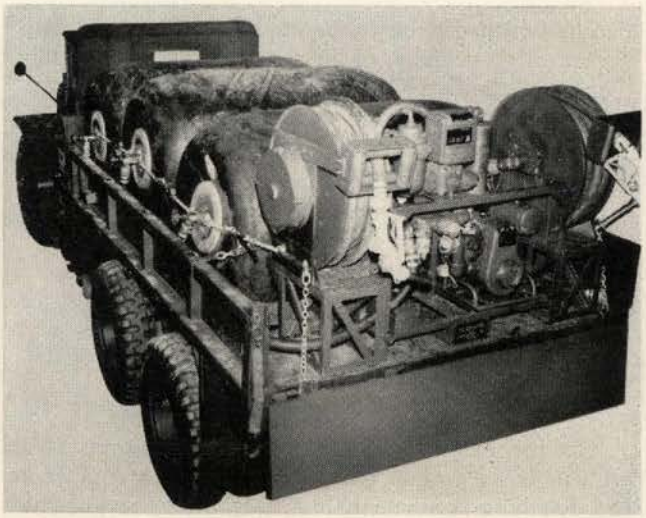
4. Major modifications of bulk fuel handling equipment were made as the result of field tests conducted during Exercise SLEDGE HAMMER.

5. A minimum package bulk refueling outfit was developed which included one 525-gallon container, an electric-motor-driven pump, securing and towing devices, a hose, couplings and nozzles. This outfit can be transported in the M59 armored personnel carrier.

During the first three months of 1958 the improvement of this equipment has continued with the following results:

1. The collapsible container (Sealdbin) has been successfully para-dropped.

2. The collapsible container (Sealdbin) has been successfully transported by helicopter and lowered directly into the bed of a cargo truck.



The kit on the left consists of three rigid 600-gallon tanks. The dispensing assembly consists of a 50-GPM-gasoline-driven pump, water separator, metering device, two 70-foot hoses on automatic rewind reels, and automatic cutoff nozzles. It is designed to operate on a standard 2½-ton or 5-ton cargo truck towing a 1½-ton cargo trailer. The kit on the right uses same components as the one on the left except that collapsible containers are used in place of rigid tanks.

3. The 600-gallon rigid tank has been successfully transported by helicopter and lowered directly into the bed of a cargo truck.
4. Two dispensing kits have been fabricated and may be standardized in the near future based upon user and troop test. These kits are shown above.

Problem Areas

The new bulk supply and refueling concept has one major problem area. This is the limitation of some of the equipment presently available. The following deficiencies must be corrected at the earliest practicable time through design of new equipment or modifications of present equipment.

1. Vehicle fuel tanks of certain existing standard vehicles have an undesirable intake capacity. The M48 medium-gun tank has a maximum intake capacity of 34 GPM, and this rate decreases as the fuel tank is filled. The M48A2 medium-gun tank takes 30 minutes to refuel its empty gas tanks. These rates are definitely not conducive to rapid refueling. This intake capacity should be increased upward to 100 GPM.
2. The dispensing capability of available dispensing kits is 50 GPM. This means 25 GPM from each hose when two are used. This is also not conducive to rapid refueling. The dispensing kit should have a capability commensurate with the vehicle fuel tank's intake capability. Consideration should be given to a vane-type pump driven by the power take-off. The pump should be placed to the rear of the truck's cab or underneath the cargo bed. The dispensing kit should include two to four automatic recoiling hoses, 70 feet long and equipped with automatic cutoff quick snap-on nozzles. *(See figure* 5.) The advantages of the power take-off driven pump are:

   a. Reduction of noise.
   b. Elimination of separate power source (gasoline or electric engine).
   c. No priming necessary.
   d. Discharge pressure remains constant by pressure relief valve.
   e. High (18-inch mercury) vacuum when evacuating air from a Sealdbin prior to filling.
   f. Less vulnerable to damage.

3. The 600-gallon rigid tanks do not provide the cargo truck with a two-way payload capability. It is true that the tanks can be readily dismounted, but this probably would be done only in emergencies or if a vehicle were on deadline. The collapsible fuel

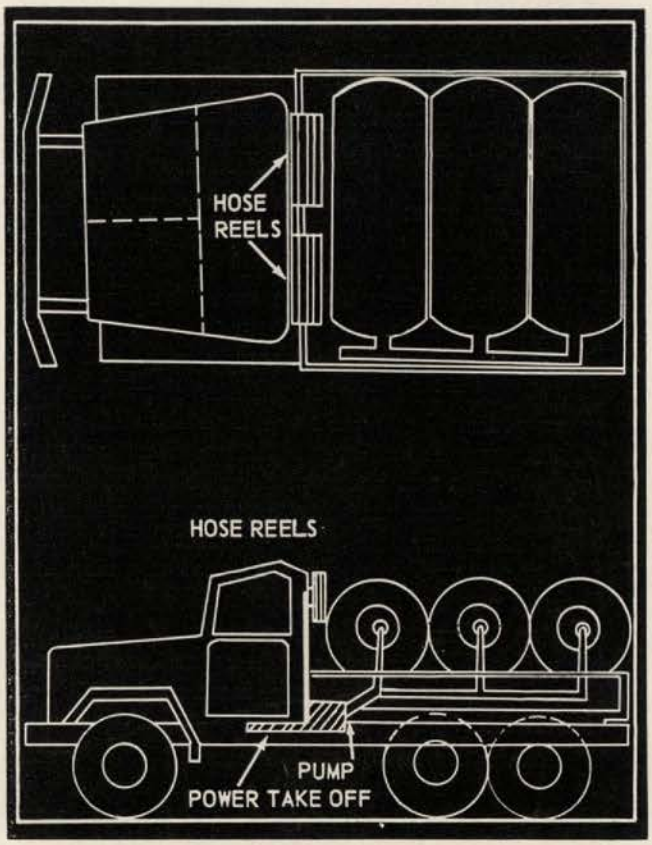


Figure 5.

cells which can be transported by air, general purpose cargo vehicles, or an armored carrier definitely increase the flexibility and capability of bulk resupply. As soon as proven dependable, they should replace the rigid tanks.

4. The 2½-ton and 5-ton cargo trucks on which the dispensing kits are mounted have a limited cross-country capability. The vehicle used for fuel distribution must have the cross-country capability of the vehicles it supports. Consideration must also be given for armor protection for the vehicle crew and cargo.

Conclusions

The problem of fuel supply for armor units is still with us in spite of modest developments in engines and fuel handling equipment. However, after years of study, development and testing, equipment which tends to reduce this problem has been included in the TOEs of armor units. We can see in Photos on pages 30 and 31 the results of research and development toward improving bulk fuel handling equipment. The 525-gallon collapsible fuel cell weighs only 3,442 pounds when filled and is easily transported by the light cargo helicopter or the M59 armored personnel carrier. The electric-driven pump represents a major improvement in weight reduction, size and sturdiness of fuel dispensing pumps.

What can be done to further reduce the fuel supply problem? There are several things that can be done which will very definitely contribute to the reduction of this problem. These ideas are:

1. Everyone must be mobile minded. Think, think of ways that the equipment provided in the ROCAD TOE can better be used to accomplish its purpose. Once you have arrived at some good idea pass it on to other people, after all we're all in the same Army. The best method is to forward new ideas to The U. S. Army Armor School where they can be studied and passed on to all concerned.

2. Everyone must be support minded. This is especially applicable to personnel in technical services and personnel in the combat arms who are serving in logistical jobs. The principle that "the impetus of logistical support is from the rear to the front" must be adhered to at every opportunity.

3. Field army concept of establishing class III supply points within 20 miles of rear boundaries of divisions will help reduce turn-around time of division supply convoys. This will permit division to provide better support to tactical units. However, to gain maximum benefit from this system, field army must keep up with the division and keep division constantly informed of the location of supporting class III supply points.

4. Divisions must establish forward class III distributing points. This procedure will reduce unit convoy turn-around time and, in turn, increase the range of tactical units.

5. Modification must be made of the 1,200-gallon experimental dispensing kits in order to use collapsible containers instead of rigid steel or aluminum tanks. This one modification greatly increases the commanders flexibility in class III resupply operations. The collapsible containers can be para-dropped, delivered by helicopter or by M59 armored personnel carriers. When empty it can be folded up into a small package, and thereby make available on a cargo truck critically needed space.

The above ideas can be put into practice in the immediate future but they do not represent a cure-all for the class III problem. Shown below is an artist's concept of an Optimum Refueling Vehicle. It incorporates the following:

1. GOERs concept of vehicular design.
2. Light armor protection.
3. Appearance of a general purpose cargo vehicle.
4. Collapsible fuel cells.
5. Five 70-foot hoses with automatic cutoff nozzles.
6. Metering and filtering devices.
7. Oil and lubricant storage space.
8. 2,000-gallon fuel capacity.

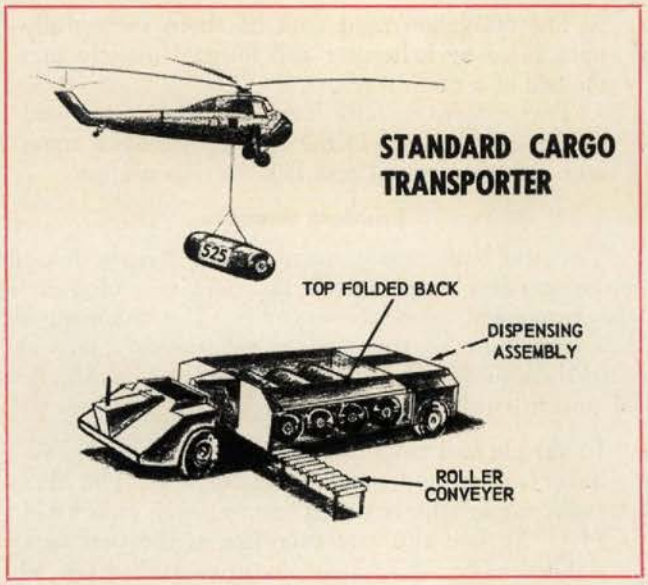


Figure 6.

It has often been said that commanders frequently do not use all the tools they are provided with to do a job and they wonder why it was so difficult to accomplish. The job of supplying fuel for an armored unit can be much easier if we use all the tools provided and if commanders and staff officers at all echelons fully understand their responsibilities. With the flexible bulk fuel supply concept, the ROCAD commander is assured adequate fuel supply under all circumstances.

The fuel problem has not yet been eliminated. However, each new development reduces the scope of this problem. It is a problem that must be challenged and defeated from the front lines to the zone of interior. Last year the 5-gallon can carried the fuel supply of the armored division; this year tank trucks carry the larger percentage. What about next year? There are definitely some irons in the fire in regard to this problem, and one thing is certain: Armor, Ordnance and Quartermaster *will take another step in the right direction.*

The ultimate task of the soldier—to engage in combat.

(U. S. Army)

COMBAT LEADERSHIP

By MAJOR CHARLES W. DRYER

Introduction

SOMETIME before the Salerno landing, General Eisenhower remarked "Sooner or later you have to step in and take your cut at the ball." These 15 words express well the ultimate task of the soldier—to engage in combat.

Battle adds some peculiar problems to leadership but, in general, it merely intensifies the problems which were present during training, in either war or peace. We will devote attention to these peculiar problems later in this period.

The great difference between combat and any other situation is the constant presence of danger and confusion. These two obstacles can be overcome only by positive leadership and by developing positive drives in the individual soldier.

How are these positive traits of leader and soldier acquired? By training—training in peace, training in war prior to entering combat, and training during the battle, and by mental factors which are not so easily described, hatred of the enemy, devotion to country, to organization and personal devotion to the leader. If training has been adequate and proper, then both the leader and follower will possess habits so well formed that correct action during combat will be automatic. When correct mechanical behavior is spurred by the mental drives we have mentioned, the unit fights not only well but brilliantly.

MAJOR CHARLES W. DRYER, Armor, received an OCS commission in 1942. During World War II he served in Europe in the 35th Infantry Division as Platoon Leader and Company Commander. Subsequently he was assigned to the 6th Constabulary Brigade. In 1949 he became Aide to General B. C. Clarke. In 1955 he was assigned as Training Officer, 29th Topo Battalion in Tokyo. Since August 1955 he has been the Unit Advisor, 157th Tank Battalion, 49th Armored Division, Texas National Guard. Presently on orders to a new assignment at Fort Knox, he has attended the Associate Advance Courses at Fort Knox, Ky. and Fort Leavenworth, Kan.

The prospect of entering battle subjects soldiers to a severe strain. Dangers, real and imaginary, are on every hand. The leader can overcome much of this strain and strengthen the mental endurance of his men by teaching them in advance what is to be expected.

The Battle is the Pay-off

Battle is fought for "Real money and for keeps." Battles are won by teamwork and not by individuals. The team spirit must be so strongly instilled and individuals must be so well trained to function as a team that teamwork, as well as individual action, becomes automatic. The only teamwork that can stand up under the confusion, the constant danger, the feeling of fear and the physical exhaustion of battle is automatic teamwork.

Success in combat is due in large measure to endurance on the battlefield. The army which can outlast its enemies will win. The day after day strain of living in dirt, of going without sleep and food, of the constant threat of death, will cause the man who is physically and mentally weak to quit. This endurance develops throughout life. Much of the mental stamina depends upon the manner of upbringing by parents, by schooling and other civilian life. The leader must remember that some of his men were "spoiled brats" and will rebel or quit if things do not go their way; these men must be made to understand that their only chance for survival lies in acceptance of unpleasantness and danger.

The prospect of entering battle subjects every soldier to a severe nervous strain. Dangers, real and imaginary, are on every hand. The leader can overcome much of this strain and strengthen the mental endurance of his men by teaching them in advance what is to be expected. An event which is foreseen and prepared for has little, if any, harmful effect. A poll of veterans disclosed 98% believed that knowing what battle was like was useful. The soldier could then prepare and plan to meet dangerous situations before they arose.

Combat demands the maximum qualities of leadership. When there is no combat, when men are living in good quarters, eating well and performing routine duties, they will laughingly or grudgingly work for the leader who has been placed over them, even though they may think the leader is weak, stupid, cowardly or unreasonable. The results will not be the maximum of which these men are capable, but because the average American has a sense of responsibility and respect for authority, he will do most of what he is told to do.

In combat, however, the poor leader will not be able to lead his men into danger, to make them face an attack, to keep their heads when hostile artillery fire is falling all around them. He will not be able to execute his plans—his men will have their own plans to desert or fight individually and not as a team.

The leader, therefore, must take every opportunity to develop his men's confidence in his leadership and in the ability and efficiency of the unit.

Combat discloses the critical importance of high morale and *esprit de corps*. These two factors are the greatest aids in developing the confidence and trust in each man and in the unit. Morale must be so high that it can withstand the shock and boredom of combat. Every man must strongly believe that what he is doing will, in the end, get him something he wants. He must have supreme confidence that he can deal with any situation and that he is a better soldier than the enemy. *Esprit de corps* must do for the unit what morale does for the individual. Every man must feel that his unit has outstanding combat ability, and that every member will sacrifice anything, including his life, for the unit. *Esprit de corps* has been the difference between mediocre and superior armies. It was strong in the Roman legions and in the French under Napoleon. It was the thing which made the 1st Armored Division hold on the beaches at Anzio, the 7th Armored Division hold at St. Vith, and which gave our assault divisions the drive to overrun beaches all over the world.

In combat the leader discovers whether his men will fight for the unit—in the presence of death and injury, poor living conditions, lack of recognition, the leader must live for his men and his outfit, by fulfilling all his roles as a leader, and by giving personal examples of endurance and courage.

Leadership Problems Peculiar to Combat

The first peculiar problem which arises in combat is that of dealing with fear. Some of the techniques that can be used to reduce the intensity of fear are:

1. Prepare the men mentally to meet fear. Tell them honestly they will be afraid so that they can prepare to meet fear.
2. Suppress signs of fear. Expression of fear causes similar behavior in others.
3. Impress the men with the fact that the enemy too is afraid.
4. Keep the men busy. Hard work provides a distraction.
5. Explain the "big picture" so that unfounded fears are exploded.
6. Have and show that you have a definite plan of action.
7. Talk to and reassure your men during battle.
8. Humor will often dissolve tense situations in combat—avoid false rumor.
9. In moments of extreme stress and desperate situations, prayer will help some men.

Some techniques by which the leader can increase the desire to fight are:

1. Tell men why they fight, but avoid "flag waving."
2. Stress teamwork and loyalty.
3. Develop and stress pride in outfit.
4. Show that you have faith in your men.
5. Develop knowledge of the enemy and his work.

The second problem of leadership peculiar to combat is the possibility or fact of panic. Panic has occurred

The leader is and ought to be a model soldier. He must be the master of the technique of war as it fits his assignment, and must constantly improve and expand his technical knowledge. In addition, the leader must give a fine example of stamina and courage.

in the best led veteran units as well as in poorly trained and led green units. Prevention is the best and al-almost always the *only* cure for panic. Once started, panic is almost impossible to stop until it wears itself out, by which time the effects may be disastrous. Therefore, only by knowledge of causes of panic, and by early recognition and removal of these causes, can the leader avert panic.

Causes of Panic:

1. Physical: Extreme climate, sickness, evidence of death, scarcity of arms or ammunition, evidence of disaster.
2. Physiological: Hunger, thirst and fatigue.
3. Emotional: Fear, anxious waiting, prolonged waiting, surprise, insecurity, isolation.
4. Social: Emotional contagion, suggestion, greater emotionality of uneducated men.
5. Morale: Bad morale, loss of confidence in leaders, loss of discipline, continuous defense, homesickness, boredom.
6. Leadership: Absence of leaders, loss of trusted leaders, insecurity.

How then to stop a panic

1. Gain attention. This usually requires forceful and novel methods—panic stricken men do not respond to reason.
2. Give clear, confident direction to the line of action which diverts men from panic. Get and keep panic stricken men busy.
3. Prevent panic by removing causes and by maintenance of discipline, morale and *esprit de corps.*

Maintain Morale

Require efficient operation by specialists concerned and give actual personal attention to assuring the best of food, clothing, shelter and equipment, assure speedy delivery of mail, etc. Men will not complain and morale will remain high if soldiers *know* that their leader is moving heaven and earth to take care of them.

Maintain the will to fight by word and example. Good morale needs more than physical well being. The spark of enthusiasm must be provided by the leader. Many famous slogans have originated in the "fight talk" of leaders. "I have not yet begun to fight," etc. Avoid phony sentiments.

Maintain Esprit de Corps

Keep the minds on the goal and on progress made. Emphasize group rather than individual achievement. Reiterate that battles are won by efficient units rather than heroic individuals. Give every follower a complete idea of the mission so that he feels that he participates in successes and has a responsibility for them. *Esprit de corps* springs from tradition —build this tradition from the moment a unit is organized.

Operations Orders

1. Give clear, complete, correct orders. Only by long and careful training can the leader perfect himself in the proper giving of orders.
2. Only by long and careful training can men learn to receive, obey, and to assume responsibility for giving orders.
3. The most common causes for failure to comply with rules are ambiguity, vagueness, incompleteness of orders.
4. The words of an order indicate what is to be done; the manner in which it is delivered indicates the spirit in which it will be carried out.

Action in the Absence of Orders

1. Lack of orders does not relieve leader from acting.
2. Leader must strive to maintain such a complete picture of the situation that he can take reasonably appropriate action in the absence of orders.

Decisions when orders are believed to be wrong

1. Extreme caution must be exercised. Two people might attack the same problem in entirely different ways with equal chance for success. Mere difference of orders from what a leader conceives to be correct is not sufficient basis for changing them.
2. Senior commanders have a much more complete picture and many have motives unknown to subordinates.
3. If the leader has positive knowledge that the situation which prompted the orders has changed materially, he may ask for new orders; failing receipt he may use his judgment in taking action which will carry out the policy of his superior.

Maintaining Efficiency

Material must be kept at the maximum by preventive maintenance, by repair, salvage and all other means. Maintain the efficiency of men by all available means. Integrate and train replacements rapidly. Insure that alternates are trained and ready to step into next higher key positions.

The Leader as a Model Soldier

It is hardly necessary to add that the leader is and ought to be a model soldier. He must be master of the technique of war as it fits his assignment, and must constantly improve and expand his technical knowledge. The leader must strive to make it possible and truthful for every follower to say "the old man *always* knows the right thing to do." In addition, he must give a fine example of stamina and courage. It is well to remember that staff officers *represent* the commander, and they must reflect the superior qualities of the leader.

Summary

All the means which the leader uses in developing leadership in himself and in building discipline, efficiency, morale and *esprit de corps* in his outfit are pointed toward the ultimate goal of success in combat.

Combat brings no really new problems to the leader but intensifies the necessity for adequate application of the qualities of leadership.

This article discusses some of the interesting technical problems the Germans overcame in preparing tanks for submerged operations.

Amphibious Tanks

By EBERHARD JOHANNIS— Translator: CAPTAIN NORBERT BRANDON

Historical Background

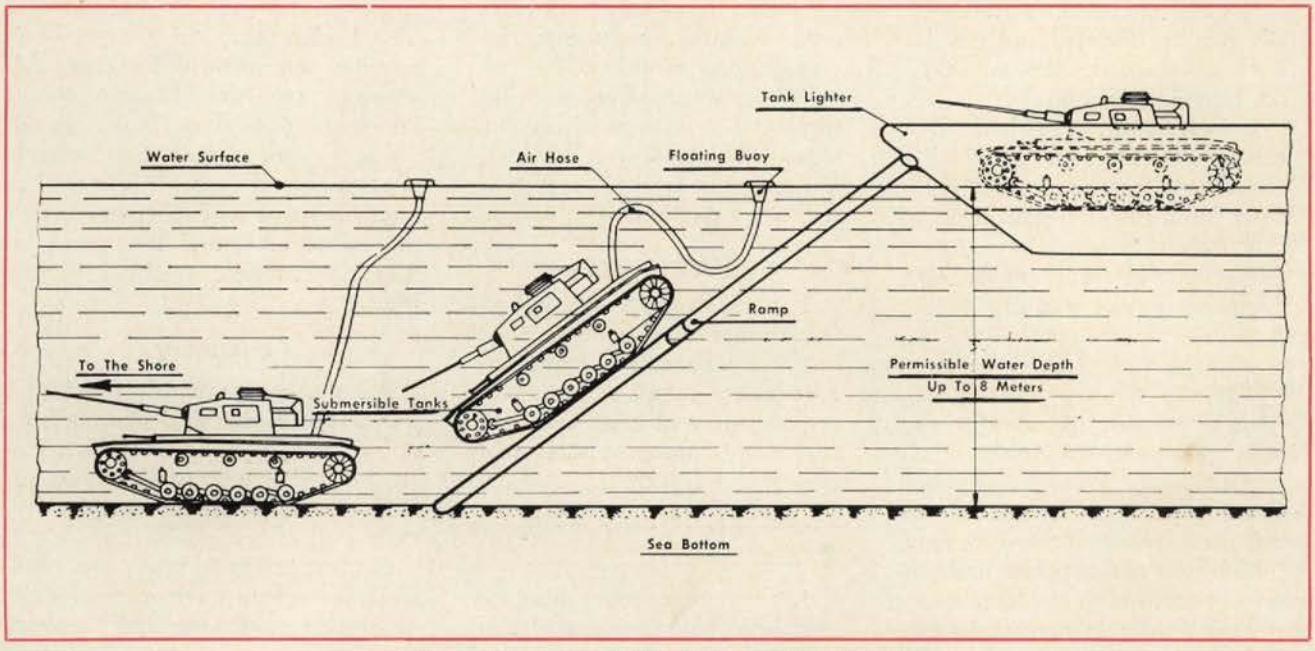
IN the Spring of 1940, a rumor of German tanks which could operate under water, was becoming more and more widespread among the German armored troops. The accuracy of this report was doubted by most people. In particular the technical specialists of the Armor branch, who could visualize, in detail, the great difficulties of the realization of such an idea, did not believe this report.

Nevertheless, this rumor proved to be true. In 1940, in absolute silence, four new armored detachments (which received the meaningless designations A, B, C and D) were established, utilizing combat-experienced officers, noncommissioned officers and men, whose tanks were equipped for submerged operation, up to a depth of eight meters (26.2 feet). The standard tanks of that period, Models III and IV, were made submersible by special processing.

These special tanks were intended to open *Operation Sealion,* the attack against England, which had been planned at that time. It was intended to bring the tanks close to the flat English shore on lighters, under cov-

EBERHARD JOHANNIS, Lieutenant Colonel, Retired, was born in Berlin. Completing his studies at the Polytechnic in Berlin he worked for the motor industry. In 1936 he was a diesel specialist and automotive instructor in the school for Armored Forces. He served as the principal engineer officer on the Staff of General Inspector and Tank Corps during 1943-45. After the war he returned to the motor industry and has had many articles published.

CAPTAIN NORBERT BRANDON, Armor, a frequent contributor to *ARMOR,* served in the Pacific during World War II with the 11th Airborne Division. Receiving his OCS commission in 1951 he is now the Company Commander of Troop A, 2d Reconnaissance Squadron, 10th Cavalry in Korea. This is the second article he has translated for *ARMOR.* The original article is in the January issue of *Soldat und Technik,* an outstanding military publication.



Submersible tanks begin their underwater trip.

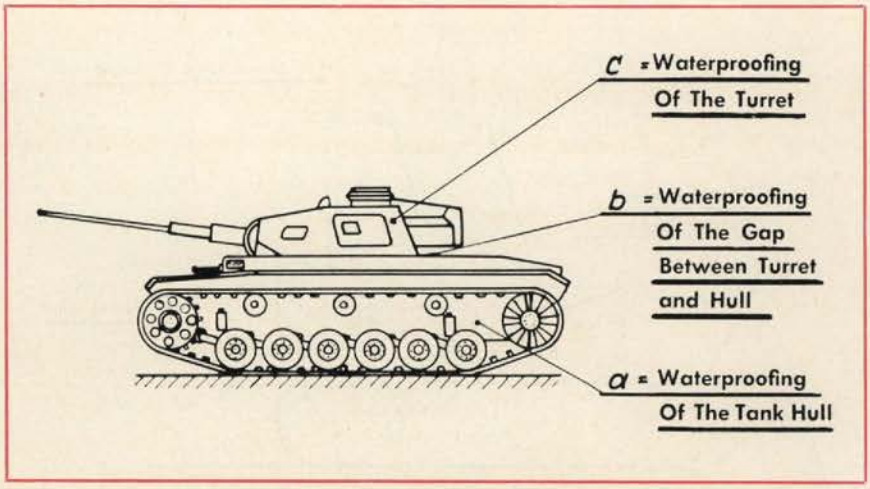
er of darkness or morning fog. At a depth of about six to eight meters, the tanks would be able to leave the transports, using a lowered ramp, and start their submerged run. On the bottom of the sea, they would have to drive toward the shore until they gradually surfaced, due to the decreasing depth, and thus reach the beach. As soon as the turret of a tank cleared the water a protective rubber cover could be blasted away from the turret and combat readiness established.

Operation Sealion, was called off. The four amphibious tank detachments were therefore available for other purposes. During the winter of 1940/41, they were included in the initial activation of the 18th Armored Division. Shortly before the beginning of the Russian Campaign, one of these detachments was reassigned. On 22 June 1941, the 18th Armored Division, with the three remaining amphibious detachments and one flame thrower detachment, entered the Russian Campaign. The first amphibious tanks crossed the Bug River under water at a point selected by engineers, for the purpose of establishing a beachhead on the other side of the river. Since practically no resistance was met on the far shore of the Bug, the underwater operation was broken off. The engineers constructed a bridge. The tanks engaged in the underwater crossing reached the enemy shore without accident. To my knowledge, this was, up to now, the first and only employment of amphibious tanks within the framework of a combat operation. But because no enemy resistance occurred, proof of the surprise effect of these tanks (a surprise effect intended to overrun a very alert and well-defended enemy), could not be obtained during this operation.

How was it possible to prepare tanks which were not at all developed for submerged operation, for such a special task? Below, some of the interesting technical problems, which required solution, will be discussed.

Waterproofing

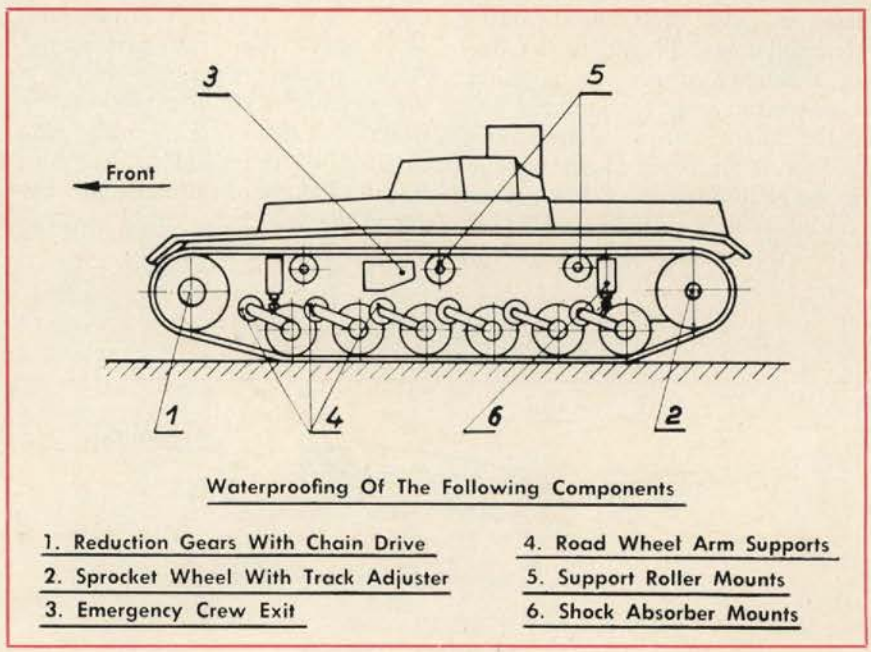
The underwater tank, according to the military specifications, was to be able to operate to a depth of eight meters. Under the most unfavorable conditions, a water pressure of 0.8 atmospheres (11.8 lbs per sq in) was to be expected. Since the underwater run could last several minutes, (Example: At an underwater speed of 0.5 meters/sec, or 1.8 km/hr [1.1 mph]) a tank would have required 1000 seconds, or almost 17 minutes, to cover a distance of 500 meters [0.3 miles]. No appreciable leakage could be tolerated at any one point, otherwise excessive amounts of water would have been forced into the vehicle interior, incapacitating vital components, and damaging, especially in sea water, through corrosion.



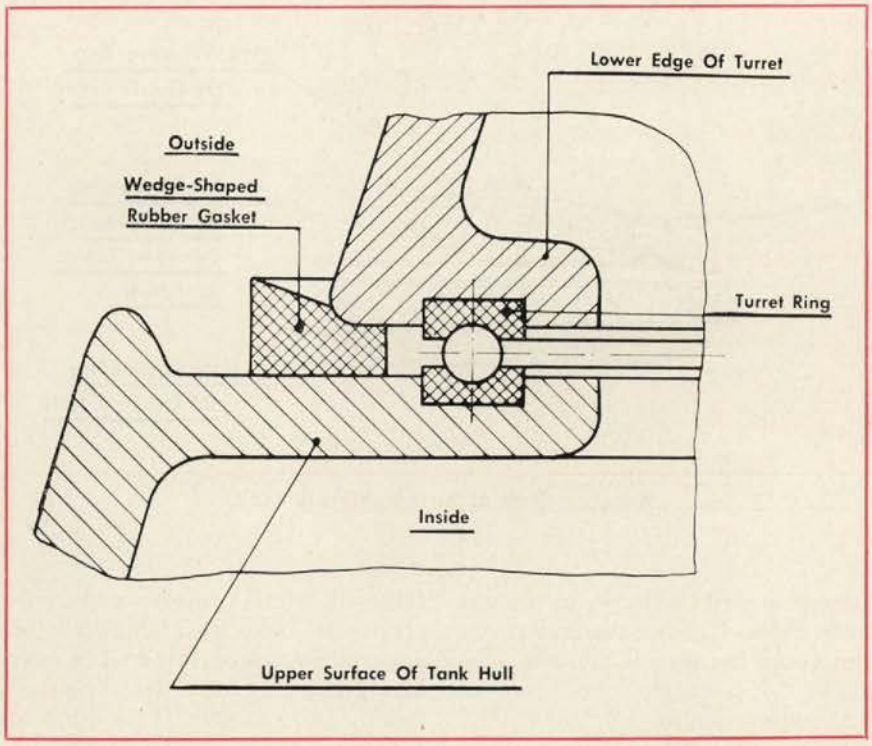
Waterproofing of an amphibious tank.

Waterproofing the Tank Hull

Every tank hull has dozens of threaded holes, openings, cracks, covered access holes, etc., which may be adequately sealed for driving over firm ground, or even for occasional fording [for example: To a depth of 1.2 meters (3.9 feet)], but which would admit too much water into the vehicle interior under 0.8 atmospheres pressure, during a submerged run of several minutes. In this connection, the access holes under the hull, the emergency crew exit, the support carrying the roadwheel suspension, the final drive, track adjustment devices, the exhaust system, the filling points for fuel, inlets and outlets for cooling air, etc., must be remembered. All these many points must be indi-



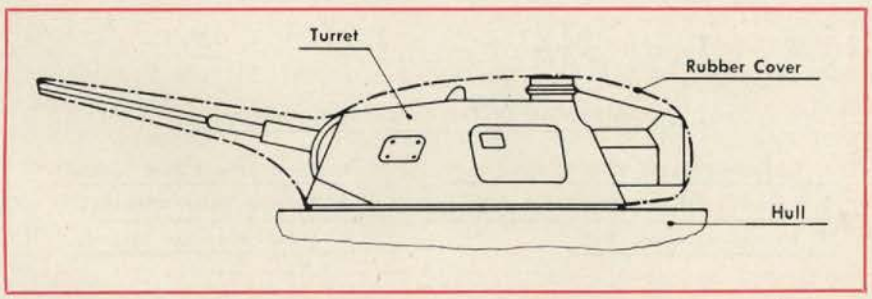
Waterproofing of tank hull sides.



Sealing turret ring gap between turret and hull by forcing in rubber gasket.

vidually checked and waterproofed through the use of sealing materials or small changes in construction.

The surprises which are possible, in spite of painstaking preparations, will be demonstrated by the example of the track adjusters on the Model III tank. Since the track adjuster was located in a separate compartment, which was adequately sealed off from the hull itself, there had been, originally, no great objection to letting this small space fill with water during a submerged run. In addition, no difficulties were encountered during the training runs conducted along the French sea coast. However, during the early Summer of 1941, when track adjustment was required on one of the experimental vehicles this was impossible due to rust. Only extensive work could make the track adjusters function properly again. A complete check of all amphibious tanks participating in the experiment showed that all track adjusters were rusted fast and could not be made to operate again using on-vehicle material. Since it was possible that D-Day was imminent, all track adjusters were put in order during a special repair session, in which all personnel of the armor repair shops participated. As the preceding example shows, in the preparation of an amphibious armored vehicle, every opening must be carefully examined to determine if water leakage constitutes acute danger to the vehicle, or could result in damage later.



Waterproofing of turret by means of a rubber cover.

Waterproofing the Gap Between the Hull and Turret

During submerged driving, considerable amounts of water would have been forced into the vehicle interior through the ball bearing of the turret ring. The waterproofing of this gap, by forcing in of a wedge-shaped rubber gasket, was relatively simple. Water pressure, acting from the outside, assured good contact and prevented loosening. Not entirely solved was the question of the means to be employed to expel the rubber gaskets so that the turret would be free to rotate.

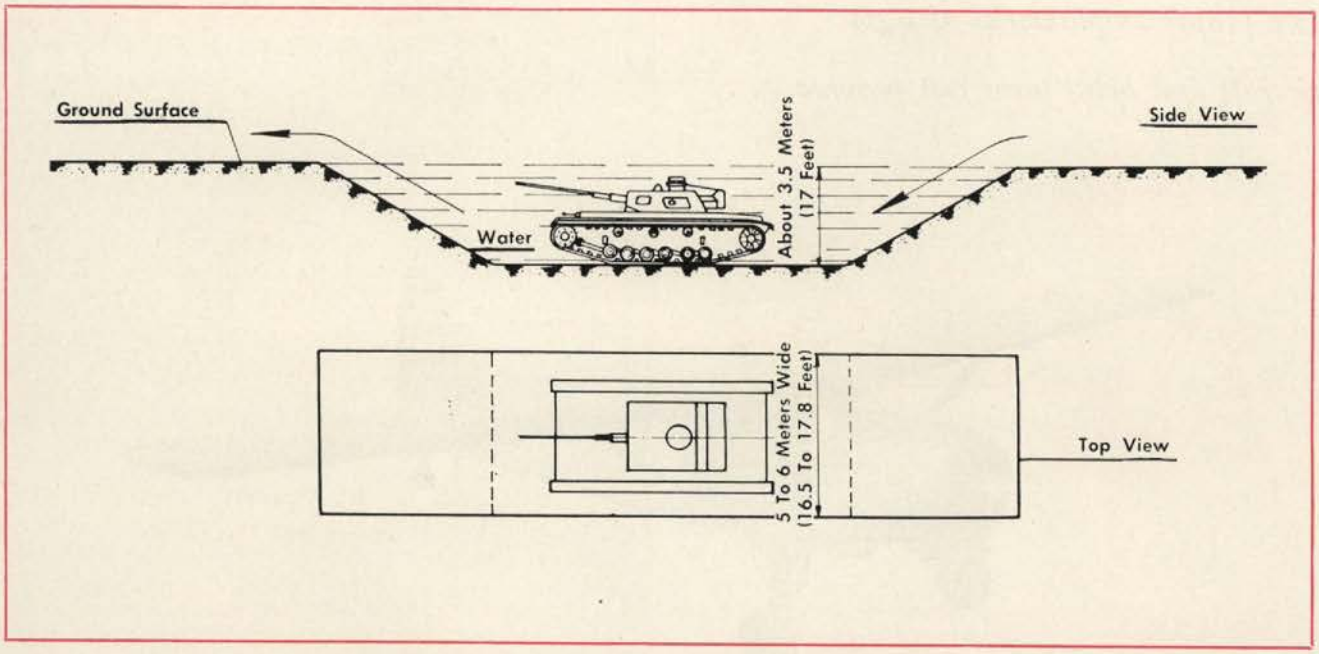
Waterproofing the Turret

The waterproofing of the turret was made especially difficult because the armament, gun mounts, optical equipment, and many vision slots had to be protected against water. Therefore, a radical solution was decided upon, in which the entire turret and armament received a rubber cover, similar to a bathing cap. A very small explosive charge, laid between the turret and rubber cover, was able to blast away the rubber cover when the tank emerged from the water.

Engine Air Intake and Evacuation of Exhaust Gases

For the operation of a powerful tank engine, fairly large amounts of air for combustion purposes are required. The Maybach engine, Model HL108, of the German Model III and IV tanks, had to be supplied with about 10 cubic meters (360 cubic feet) per minute of air for combustion, at 2000 RPM. This problem was overcome by the use of a heavy air hose, supported by a floating buoy, which the amphibious tank dragged through the water, thus permitting the intake of the air needed for combustion. (This is depicted in the drawing on page 42.) It must be understood that such underwater trips were possible only with a calm water surface (no wind).

The exhaust gases were, as usual, evacuated through a muffler. A unidirectional check valve was simply installed at the end of the exhaust pipe. This was intended to prevent water from filling the exhaust system. The drivers had strict orders never to let the engine run at low speeds, and especially not to let it die, be-



Practice basin for training with submersible tanks.

cause then the flooding of the exhaust system and of the engine was to be feared.

In comparison to the engine, human beings require relatively little air for breathing. Eight to 15 liters (⅓ to ⅔ cubic feet) per minute is considered adequate. Therefore, a five-man tank crew required from 800 to 1500 liters of breathing air for a 20-minute run. Since the crew compartment of a tank contained about 10 cubic meters (360 cu. ft.), no serious shortage of breathing air resulted from the lack of a fresh air intake.

Gyro Compass for Blind Underwater Operation

Neither the vehicle driver nor its commander could see under water. As a result, a directional instrument had to be provided for the driver. This was a gyro compass, a standard item on the submersible tank, since the usual magnetic compass failed due to the large metal mass of the vehicle.

Preparation for Submerged Operation

At first, riding a tank under water gave everyone a very uncomfortable feeling. Especially the driver had to remain calm and collected, since a blunder on his part could endanger the entire crew. Through familiarity and practice, the initial difficulties, which, unfortunately, led to the loss of one tank crew, were soon overcome. In specially constructed basins, submerging, surfacing and remaining under water were practiced. At the same time, during these submerged trials, all seals and special equipment were re-checked for proper functioning.

Submerged Driving Technique

An underwater run with amphibious tanks can only be conducted at carefully reconnoitered locations. Where the crossing of a river is concerned, the entry and exit points must be thoroughly examined. Also, nightly sounding of the selected underwater stretch must be carried out, to assure that the safe maximum operating depth is not exceeded at any point. In addition no large obstacles, boulders, sunken ships, etc., should lie along the underwater route.

The initial fear, that a muddy river or sea bottom would interfere with driving, proved to be groundless. A German tank, weighing 20 tons combat-loaded, displaces approximately 15 cubic meters (540 cubic feet) of water. As a result, the effective weight, submerged, is reduced from 20 tons to five tons, so that the tracks then rest on the river bottom with only one-fourth of their original ground pressure (for example, with 2.8 lbs, rather than 11.2 lbs per sq. in.). With such low ground pressures, tank tracks will hardly sink into even the softest bottom. The feared digging-in on the river bottom did not occur.

As a matter of principle, the underwater runs were made in the lowest gear and without shifting while submerged. The engine was required to operate between its medium and maximum RPM. Low engine speed was intentionally avoided, so that the power plant could not stop under any circumstances. But it was just as undesirable to let the engine run at extreme, possibly excessive, revolutions. The previously mentioned gyro compass served to maintain proper course.

Maintenance

The submersibility of several German tanks had been achieved through painstaking detail work in careful waterproofing. It was soon apparent that this waterproofing would become unserviceable after a few days, sometimes even a few hours, of road marching, so that a new underwater commitment would not have been immediately possible. Therefore underwater-operation modified tanks could only be committed for a submerged run if they could be prepared immediately prior to the attack, and preferably close to the point of commitment.

The German technicians proved in 1940/41, that the problem of submersible tanks could be solved. The soldier must decide if the result is worth the effort.

The proper employment of light aircraft and helicopters can provide . . .

(U. S. Army)

Rapid Reconnaissance, Now!

By MAJOR HARRY H. HIESTAND

A PRACTICAL and valuable application of Sky Cavalry is today, readily available to commanders of reconnaissance squadrons organized under ROCAD or ROCID. Availability of aircraft permitting, the same potential applies to armored cavalry regiments.

The current tables of organization of armored and infantry divisions include all the equipment necessary to greatly extend the reconnaisance and security capability of the division reconnaissance squadron. Even in the absence of the authorized radar and television equipment and the trained personnel to employ these items, the squadron commander can greatly improve the speed and effectiveness of his unit. The aircraft, ground vehicles, radios and men are on hand. These necessary elements, which, when coupled with an open mind and a willing spirit, compose all the essentials.

The use of Army aircraft to support and extend the capability of ground reconnaissance is not new. However, little has been published on the precise techniques of employment and the gains which may be obtained.

Recent Seventh Army field training exercises provided a vehicle for testing the reconnaissance portion of the Sky Cavalry concept. The 2d Armored Division's Reconnaissance Battalion was designated to provide the personnel and equipment for the test. Stipulated test objectives, of application to this article, were as follows:

1. To determine the utility of light aircraft to detect reconnaissance targets under varying conditions of visibility, location and circumstances (on & off roads; in woods or open; camouflaged; moving or still).
2. To determine the difference in speed of execution of the reconnaissance mission when light aircraft are introduced in the manner proposed.
3. To determine the vulnerability of light aircraft.

The results obtained indicated some very definite and practical possibilities in the region of aerial support for ground reconnaissance work.

The tests were conducted in conjunction with large scale field exercises. While this setting provided for

MAJOR HARRY H. HIESTAND, Armor, received his OCS commission in 1942 and was assigned to the Far East. Wounded early in the War he was assigned to Fort Hood. In 1946 he was assigned to the 1st Cavalry Division in Japan. Returning Stateside in 1949 he was Company Commander in the 44th Tank Battalion. Attending the Associate Advance Course at Knox he was next the Assistant PMS&T at Michigan State. Moving to Europe in 1956 he was the project officer on the tests described in this article and Executive officer of a Reconnaissance Battalion. He is the Director of Instruction at the Seventh Army Tank Training Center.

plenty of troops and vehicles on the ground, the difficulties in achieving truly objective test conditions were increased by vagaries of the tactical situation. Very simple control factors were untilized. When testing on the platoon level, half the platoons involved were provided with supporting aircraft. The same controls were used at company level. On reconnaissance, security or screening missions, the units enjoying aircraft support were given a zone one and one-half times the size of that for which the non-supported ground units were responsible. In spite of difference in size of zone, each test that was not influenced by some external invalidating factor, demonstrated that the Sky Cavalry supported ground unit was able to complete its mission in one-half the time required by the non-supported control unit.

An original premise of the Sky Cavalry concept was the possibility of replacing a ground reconnaissance troop with a Sky Cavalry troop. While this feature was not included among the test objectives, project results deny the feasibility of this change. The major inhibiting factor is weather. In the event of non-flying weather, the reconnaissance squadron would be faced with a loss of one-fourth of its former reconnaissance capability.

A special rifle element was trained to test the effectiveness of airlanding small forces behind enemy lines. This test met with only moderate success. One significant result was the conclusion that a special force in being was unnecessary. Selected riflemen from the reconnaissance squadron's rifle squads could, with only a few hours special training in marking of pick-up points, etc., be made into an effective helicopter-borne unit.

Employment of the Reconnaissance and Surveillance section and the Target Acquisition section of the Aviation Company, on their proposed mission, will certainly be of assistance to the division commander. However, the advantages to be gained by employing all or part of these aerial sections in support of the ground units of the reconnaissance squadron are of more significant value. When the squadron or an element of the squadron is deployed in advance of a larger force for the purpose of quickly developing the situation, aerial augmentation has much to offer. Besides, the aircraft are now on hand and the electronic equipment is not. Also trained operators are not available at using level.

Sky Cavalry test results indicated that the maximum number of aircraft which could be profitably employed with a ground reconnaissance unit, was a ratio of one reconnaissance helicopter to each integrated reconnaissance platoon. The use of a higher ratio of aircraft to ground forces resulted in more situations being reported than the ground unit could handle. Training Test 17-35-2 specifies the assignment of one reconnaissance helicopter to each armored reconnaissance company. The best that can be said for this ratio is that it would be better than none.

For this operation to be of maximum benefit, each aircraft must be furnished with a trained aerial observer. Both the pilot and the observer must train with the ground force with whom they are to work. Conversely, the ground force commander must be fully cognizant of the capabilities, limitations and peculiarities of his aerial support. One feature of the test results was the utter failure to obtain significant benefits on every operation which was not preceded by a "marrying-up" period of several days. The failure was usually the fault of the ground force personnel who, unless thoroughly briefed regarding the aircraft's capabilities and limitations, considered the aircraft a nuisance that complicated an already cluttered radio net. It should be noted that this briefing must include all personnel in the unit.

One very important technique developed during this test was the necessity for very clear definition of the boundaries to be observed by the aircraft. These boundaries must be plainly marked by terrain features which are unmistakable from the air.

Mutual recognition signals; distinctive marking of commander's vehicles; exchange of call signs; complete understanding of the mission; refueling arrangements, all are matters of vital importance to a successful air supported reconnaissance mission. As small a matter as the use of a different scale map by one party can result in a major difficulty.

With the advent of the atomic weapon era, the advantages to be gained by the ground commander faced with the problem of widely scattered units certainly reduce all these troublesome details to a minor consequence. Today we visualize far greater distances between the centers of mass of our organizations. Consider the advantages of an aerial radio

(U. S. Army)
Personnel selected as observers shown being oriented on a fixed wing aircraft.

relay station or the use of message drops to an isolated segment of the organization. With rotary winged aircraft, the observer can land beside the commander's vehicle and explain a complicated report, thus avoiding the necessity of a prolonged radio transmission which is subject to interference, interception and perhaps fatal misunderstanding.

A simple experiment, easily conducted during a period of field work, will graphically demonstrate the value of an aerial OP for the ground reconnaissance unit.

Select an area of varied terrain, hilly, open and wooded. Give two platoons an identical mission, route or zone reconnaissance and send them along parallel routes. Each route should have a main road and an approximately equal number of lateral roads. Augment one platoon with a helicopter. Give that platoon an area one and one-half times the width of that for which the non-supported platoon is made responsible. Send both platoons across the line of departure at the same time. Ride with one platoon for a while and then with the other.

Assuming each platoon plays the game and does its job thoroughly, a marked contrast will be noted between the two platoons. From the standpoint of speed and efficiency, the difference will be similar to inspecting a squad room blindfolded compared to performing the inspection in the normal manner. The advantage of possessing an aerial OP will enhance the efficiency of the supported platoon by speeding the check out of lateral routes, providing route guidance and security against ambush.

Helicopters repeatedly have been referred to during this discussion. Reconnaissance helicopters used in the test were the H13E. For certain missions, fixed wing aircraft are preferable. This is because of higher speed and greater range. From the standpoint of all around performance, however, the helicopter is preferred. The ability to land anywhere a ground vehicle can travel allows the capability of easy refueling. The helicopter can remain with the supported unit overnight if no movement is made. In fact, limited helicopter movement under certain conditions of darkness is entirely feasible. The necessity for a higher ceiling and greater visibility limits the use of the fixed wing aircraft. To this is added the handicapping requirement for some sort of runway. The helicopter's capability of being physically based with the unit it is supporting, is of almost overriding importance. This is particularly true in the case of communication failure. The following report of one test conducted under conditions of poor visibility serves to provide an interesting example.

(U. S. Army)

The H13 helicopter was used by the 2d AD Reconnaissance Battalion in the test.

1. *Objective.* To determine the utility of the Sky Cavalry reconnaissance platoon in the screening mission.

2. *Procedure.*

a. Two ground reconnaissance companies were given the mission of screening the withdrawal of a combat command. One company was supported by light aircraft using a ratio of one reconnaissance helicopter to each platoon. The other company was not augmented. The supported ground unit was made responsible for an area one and one-half times the frontage allocated to the unsupported company. In addition the supported company had an exposed flank.

b. H13 helicopters moved from the Sky Cavalry CP to a forward refueling point from which they were dispatched to the supported company. Each aircraft reported directly to the ground company commander who directed specific missions. Action by the supported company commander was dictated by his immediate tactical situation.

c. Refueling at the forward location was accomplished by utilization of an H34 transport helicopter.

d. Ground unit vehicles displayed distinguishing markings for ease in identification and location. The helicopters frequently landed beside command vehicles in order to obtain instructions or to convey detailed information which would have otherwise required lengthy radio conversations.

3. *Results; Excellent.*

a. Aircraft were able to provide early warning of the approach of enemy elements not yet in contact with the friendly ground units.

b. Aircraft were able to lead friendly ground units over a secure route in a manner which permitted a surprise attack to be carried out upon the flank of an enemy column.

c. Aircraft twice assisted in extricating ground units from

43845

untenable positions. Friendly elements were not aware they were in danger of being cut off. Helicopters led out each ground unit over a secure route.

d. Reconnaissance helicopters detected two large enemy armored columns and two enemy infantry battalions. These were reported for fire missions.

e. Reports from aircraft observers were instrumental in eliminating the ground commander's uncertainty regarding the situation on his exposed flank.

4. *Comments.*

a. The *unsupported* armored reconnaissance company commander found himself unable to screen the numerous routes through his sector. Although he had the smaller width, front to screen, he was unable to move his limited forces efficiently to counter enemy advances in the manner enjoyed by the Sky Cavalry supported unit. At least one small enemy element slipped through his area without detection.

b. The *supported* unit commander was very enthusiastic about the aircraft support. He felt that it completely clarified the enemy situation in his sector at all times. His knowledge of the enemy's movements exceeded that of the enemy commander.

When contemplating the employment of light aircraft in support of reconnaissance, all possible information of the enemy, weather and terrain must be considered. The locations of enemy antiaircraft artillery, known enemy ground positions and enemy air and ground activity are particularly important. Employment of light aircraft over heavily defended sectors must be avoided because of vulnerability of the aircraft.

Vulnerability of light aircraft to small arms fire is an important consideration, although not as serious as popular opinion would indicate. An extensive pilot training course in contour flying and the techniques of observing into the trees from a low oblique angle will increase proficiency in observation and reduce casualties from enemy ground fire.

Operations on flanks and in rear areas rather than above heavy concentrations of enemy troops will do much to preserve supporting aircraft. If the situation is such that enemy high performance aircraft are a probable hazard, a degree of security may be achieved through the use of fixed wing aircraft employed at a higher altitude, in an overwatching role.

Considerations of terrain are of particular importance when employing light aircraft in tactical operations. Aircraft have an inherent flexibility which permits approaches to objectives over routes which offer maximum opportunity to exploit both cover and concealment, such as cliffs, ridge lines and wooded areas. These should be carefully studied in order to gain full advantage of natural cover in the selection of routes of approach. An unmasked frontal approach into a defended area should be avoided.

Weather minimums will influence the ability of Army aircraft to carry out assigned missions. Influencing factors in the determination of weather minimums are: the experience of the pilots, the type aircraft employed, the urgency of the mission, the navigational aids available and the terrain along the flight routes.

Sky Cavalry, employed in the manner thus proposed, can be of very great asistance to the commander concerned with reconnaissance and security. By properly employing his aircraft, first in areas known to be free of enemy, then working toward the fringes of suspected enemy concentrations, the commander can reassure himself regarding the security of his flanks without deploying a sizable ground force. In effect, the Sky Cavalry reconnaissance unit becomes truly an *economy of force* element of superior efficiency.

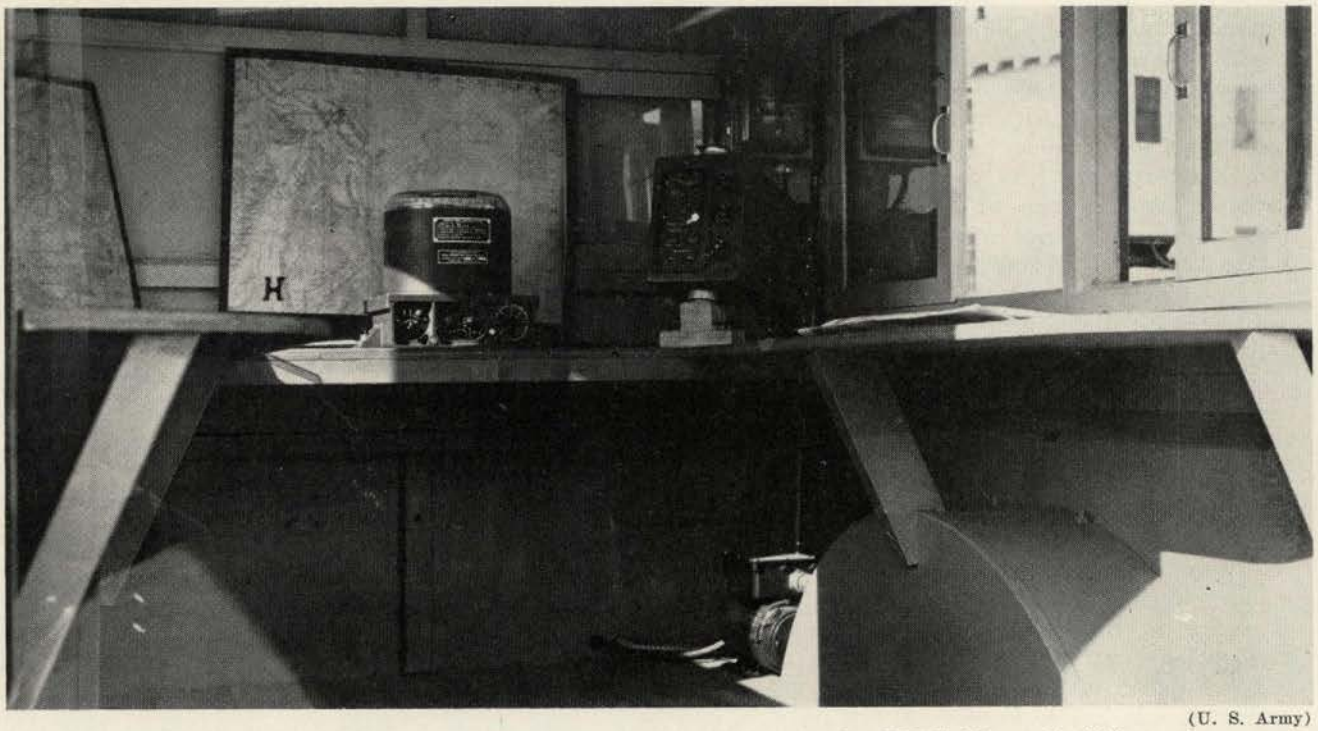
A high ratio of maintenance hours to flying hours is normally associated with helicopters; the following extract from the maintenance portion of the test report throws an optimistic light on this important phase. Figures applying to the H13 Helicopter only, are shown above.

Type Aircraft	Number of Aircraft	Total Hours Flown	Total Hours Maintenance
Helicopter, H13	6	231	100

1. ____ *table one* shows maintenance requirements for Sky Cavalry platoon aircraft during field tests. The "Total Hours Flown" column includes both combat missions (flights over or near enemy forces) and administrative missions (weather checks and reconnaissance for Sky Cavalry command post locations). The "Total Hours Maintenance" column includes the time devoted to maintenance in the field, *plus the necessary maintenance performed before and after each testing period.*

2. At no time during the field exercises was more than one rotary wing type aircraft deadlined for maintenance. To meet aircraft operational requirements, maintenance was deferred to periods of poor weather or to periods when no mission was assigned ____.

Continuing research and development will, in the future, give us higher speed, more agile and less vulnerable Army aircraft. These features combined with better communication will enhance greatly the "target acquisition" potentialities of a Sky Cavalry unit. The speed, range and vulnerability to ground fire of the present Army aircraft normally preclude the detection of lucrative atomic targets in enemy rear areas. Until higher performance aircraft are in the hands of troops, light aviation will have only a limited capability in this field. However, without any fancy electronic equipment, with a little imagination, thorough combined training and the blessings of the division commander, the reconnaissance squadron, supported by elements of the aviation company, can halve movement time on reconnaissance missions, efficiently pinpoint the fringes of the enemy's force and reassure the commander about *Where they ain't.*



(U. S. Army)

Shown above is a land navigation system currently under experimentation by CDEC. Mounted within a cab on a conventional ¾ ton truck for experimental purposes, the system is capable of being installed in most any type military vehicle. At left, is a gyrocompass and grid correction base. A position computer indicator is at top right and the power unit is mounted below. An odometer connection unit is installed beneath the front seat and is connected to the drive shaft.

Improved Land Navigation*

Man, since he left the immediate vicinity of his cave, has been dependent upon some means of navigation, whether his travels be over land or water. The stars, sun and landmarks were the first directional aids. Later came the crude compass as used by Norse and Chinese seamen. and landmarks were the first directional aids. Later came and aircraft of this day.

Travel over unmapped or poorly defined terrain, however, is still performed with the assistance of instruments which have seen little change in many years. This equipment is subject to miscalculation due to the element of human error.

The U. S. Army Combat Development Experimentation Center is currently experimenting with instruments which may change land navigation for all types of military vehicles to a simple formula. These instruments were developed by the Army Engineer Research and Development Laboratories at Fort Belvoir, Virginia to guide vehicles to a desired destination through the use of a mechanical computer.

Consisting of four component units, the system may be mounted in most any type of Army vehicle, from a quarter-ton to a heavy tank. The equipment provides information as to vehicle heading and position in map coordinates at all times. In addition, direction to home base, and distance and direction to destination are available on demand.

The four units are composed of a gyrocompass, position computer, odometer transmitter and power supply. The compass furnishes bearing data to the computer which converts this bearing and distance information from the odometer unit into continuous indication of rectangular and polar coordinates.

Upon completion of experiments, CDEC's findings will provide the Army of the future with some of the answers a land navigation system must have in order to permit travel over uncharted land masses and travel under conditions of poor visibility. The system will give accurate bearings to an objective and maintain these bearings correctly.

Through experimentation with instruments such as these, furnished by Army Technical Service agencies, CDEC is contributing to improvements which will greatly aid the Army in preparing for the future, and increase the Army's capabilities on any nuclear battlefield of tomorrow.

* Prepared by the Public Information Office, Combat Development Experimentation Center, Fort Ord, California.

(U. S. Army)

With the aid of this terrain moderator board the Commanding Officer of CCA, 3d Armored Division, indicates the tactical situations of a problem during the Delay and Defense Course.

Delay and Defense Course*

Commanders in West Germany persistently feel the scarcity of time and terrain for training their men. To adequately fulfill their mission in guarding the West, they must find substitutes. Officers of the 3d Armored Division recently fought mock battles in a special course designed to meet this problem. The Delay and Defense Course, as it is named, served as a means to familiarize officer personnel with changes in doctrine as well as to review those areas revealed as weaknesses by recent field exercises.

Training areas large enough for armored maneuvers are available to units stationed in West Germany only on a part-of-the-year basis. They are used for training preparatory to testing and for the actual testing. But they are not available to correct deficiencies that the testing reveals. It is at this juncture that some such alternative as the Delay and Defense Course proves valuable.

Commanders also find that performance of the important home-base training demands a major portion of their time. But time is also needed to learn the massive technical and tactical know-how contained in the ever changing field manuals. It was found in the 3d Armored Division that much time could be saved the officer personnel in this task through the institution of a formal course.

With the new ROCAD doctrine it was mandatory that every command within the 3d Armored Division conduct a Delay and Defense Course. Perhaps one of the best examples—primarily because of its elaborate terrain model —was taught at Combat Command A. Running for two consecutive mornings at four hours a session this discussion-type class worked at Tank, Infantry and Artillery problems.

Five situations were analyzed on a model whose terrain varied tactically from the ideal to the mediocre to the poor. Each situation simulated a battle position. Commanders on each level of the chain of command would discuss orders relating to the situation that were given to them by their superiors. They would first describe the mission of the group that they commanded, they would develop a plan, and finally they would issue orders to their team commanders. The team commanders would then think through a similar process with regard to the problems within their sphere of activity.

After each officer finished with his analysis of the problem, the course was opened to general criticism. Alternative solutions were discussed and finally the preferred solution was presented. After the discussion the enemy was moved in and a new situation was analyzed in the same manner.

All action took place on a scale model which represented 31,000 square meters of actual terrain. The model was constructed out of wood and built up with plaster of paris. Railroads, streams and cities were etched in. Model vehicles were used in representing the enemy's positions.

Use of such a course as the Delay and Defense Course has brought quick understanding and application of new doctrines by the officer personnel. It has also provided an effective substitution for training that would otherwise be missed for lack of time and terrain.

*Prepared by the 3d Armored Division Public Information Office.

NEWS NOTES

A New Teletypewriter

Development of a teletypewriter, believed to be the fastest general purpose message printer in communication history and capable of typing at a rate of 3,000 words a minute, was announced recently by the Department of the Army.

The revolutionary new device was developed jointly by the U. S. Army Signal Corps and the Burroughs Corporation, Paoli, Pennsylvania. It prints four full lines of text a second, which is 50 times faster than a news service teletypewriter, 45 times faster than an average typist, and 20 times faster than the average person can talk.

Operating at a lower speed of 750 words a minute to meet Army Signal Corps requirements, the new electronic messenger will be the major unit in the Army's new family of teletypewriter devices, all operating at 750 words a minute. Together they make up the fastest known military typewriter network in the world, providing the increased message speed vital for modern atomic-age maneuvers.

Draper Trophy Won by Platoon from 32d Armored Battalion

The Draper trophy, an annual award to the outstanding Tank Platoon in a designated Armored Division, was won this year by the 2d Platoon, Company D, 32d Armored Battalion, 3d Armored Division. The 3d Armored Division was designated by CONARC to administer the tests this year. A complete story will be published in the next issue of *ARMOR*.

The commanding officer of the winning platoon is 1st Lieutenant Richard S. Lovelace. The Platoon Sergeant of the winning platoon is Master Sergeant Tyler B. Adams.

New Body Armor

The Quartermaster Corps has developed and is making limited issue of protective clothing to make a little safer the dirty job of mine clearing.

The new armor comes in five parts. There are trousers and jacket of white 4-ply nylon which give protection to arms, legs and the lower body, a lightweight armored vest for additional protection for the chest and stomach, an attachment to protect the throat, and a face and head protector, including shatterproof goggles to fit over the helmet.

"Mine clearance armor is designed to be worn as a ballistic liner under the combat clothing," a QM explanatory statement says. "It is sufficient to protect soldiers from the effects of mines exploding nearby, but will not provide enough protection when a soldier steps on a mine himself."

The additional protection provided by the vest over the suit gives the effect of a 12-ply protection to the chest, equal to that given by the standard infantry armored vest.

New Production Methods

Assembly-line manufacture of artillery shells by a unique steel-saving, mechanized method has begun in a new building at Berwick, Pennsylvania.

The hot-cup/cold-draw technique saves critical raw materials—both billet and tool steels—while producing shells that are easier to load and more accurate in flight than those made by conventional procedures. Savings in starting material alone are claimed to be upward of 25 percent, with almost 50 percent less man-hours required. The method was perfected by the ACF division in cooperation with the Philadelphia Ordnance District of the U. S. Army Ordnance Corps and the Frankford Arsenal.

Officials say that the ACF-developed technique permits savings that would be most important during a national emergency when both steel and manpower might be in short supply.

ACF pointed out that hot-cup/cold-draw shells fired at the Army's Jefferson Proving Ground in Madison, Indiana, traveled farther on the same powder charges than conventionally produced shells, and possessed better balance and concentricity, resulting in greater accuracy. Most of the new-method shells weigh within a half-pound of the norm—in contrast to a four-pound, 13-ounce tolerance for conventionally made shells—and as a result necessitate less field adjustment in the powder charge or artillery piece elevation when fired.

Combat Surveillance and Target Acquisition

A tripartite conference with representatives from the United States, United Kingdom and Canada met at the Pentagon during the latter part of November, to discuss combat surveillance and target acquisition.

Meeting under the sponsorship of the U. S. Army Assistant Chief of Staff for Intelligence, Major General John M. Willems, the conferees considered the need for an increased capability to collect more explicit and timely information to support our improved weapons system in a future war.

Items discussed included: requirements for combat intelligence information, organizational and operational concepts and the development of hardware needed for combat surveillance. The means to increase the commander's ability to make decisions faster and more accurately include radar, infrared devices, photography, television, aerial platforms (such as manned and drone aircraft), and automatic data processing equipment.

The Assistant Chief of Staff for Intelligence has principal Army staff responsibility for combat surveillance.

Two Missile Commands in STRAC

Two U. S. Army Missile Commands are now included in the Strategic Army Corps (STRAC), the Army's mobile "ready force" designed to meet the threat of limited war and potential trouble spots around the world, the Department of the Army announced recently.

The two STRAC Missile Commands are the 3d (Air Transportable) at Fort Bragg, North Carolina, and the 2d (Medium) at Fort Hood, Texas. The addition of the missile commands, equipped with either conventional or atomic-warheaded Honest John rockets and Corporal guided missiles, provides ground forces of the United States and its Allies with tremendously increased firepower.

Other U. S. Army Missile Commands are the 1st (Medium) in Italy, and the 4th (Air Transportable) in Korea. Air Transportable Missile Commands, with a strength of approximately 1100 men, are normally composed of an Honest John battalion, an infantry element for security, and logistical support elements. The typical Medium Missile Command contains approximately 5,000 men with a Corporal battalion, two Honest John rocket battalions, an armored infantry battalion, a sky cavalry battalion for target acquisition, plus normal support elements.

The Army's missile commands are designed to furnish accurate fire support, regardless of weather or visibility conditions. They cannot be deployed as independent units since no ground-holding capability has been included within their organization—infantry units are included primarily for local security purposes.

Other major units which have been identified as part of STRAC are: Headquarters XVIII Airborne Corps and the 82d Airborne Division, Fort Bragg, North Carolina; 101st Airborne Division, Fort Campbell, Kentucky; 4th Infantry Division at Fort Lewis, Washington; 1st Infantry Division, Fort Riley,

Kansas; the 2d Infantry Brigade, Fort Devens, Massachusetts; the Armored Combat Command at Fort Polk, Louisiana; and the 3d Armored Cavalry Regiment, Fort Meade, Maryland.

Army to Test Reservists at Nike Sites

Use of Army Reservists to augment active Army Nike batteries during emergency operations will be tested starting next February, the Department of the Army has announced.

If the tests prove successful, the assignment of reserve personnel with missile skills for training with nearby active Army units will provide the Nation with a ready reserve mobilization force of missile specialists.

The test will run approximately six months using two active Army Nike missile batteries of the U. S. Army Air Defense Command in the Chicago area. The two specific batteries will be designated at a later date by the Commanding General, U. S. Army Air Defense Command, with headquarters at Colorado Springs. The test will be the basis for evaluating a general program which would utilize Army Reservists throughout the United States.

Objectives of the test will be to determine the capability of the on-site Nike battery to train operator type Army Reservists and to maintain the proficiency of USAR personnel with prior Nike service. At present there are no USAR missile units to which Army Reservists can be assigned to maintain their proficiency gained from prior missile service.

An Overland Train

Award of a contract for design and construction of a 450-foot long, 12-unit overland train for transporting heavy cargo in Arctic regions and in other remote world areas lacking land transportation facilities was announced recently by the Department of the Army.

The contract for the vehicle went to R. G. LeTourneau, Inc., of Longview, Texas, following evaluation of competitive design proposals from eleven different manufacturers by the Army Transportation Corps.

Development of the off-road overland train will provide the Army with one answer to its need for a combination of maximum mobility and high cargo-carrying capacity in remote, undeveloped locations such as polar or desert regions where supply routes are long, fuel supplies scarce and roads nonexistent.

Feasibility of the overland train concept has been determined through extensive testing since 1956 by the Army Transportation Corps of a smaller, 4-unit experimental model whose capabilities have been demonstrated under widely varying climatic and environmental conditions. As part of these tests, the train traveled long distances over the Greenland ice-cap.

The Lobber

Missile resupply in combat is just around the corner. A full-sized model of a six-mile missile able to drop up to 200-pounds of critical supplies was displayed during the Infantry Conference by the Convair Corporation as part of the Army Quartermaster Corps display on things being done to make the infantryman more effective.

The new free flight missile combines rocket propulsion with mortar aiming to achieve accuracy in delivering food, ammunition, ordnance and signal parts to forward units. Lobber can also be converted to deliver napalm and high explosive so that it can double as a weapon if needed.

Convair says that this first Lobber missile is a prototype and that work on longer range missiles with greater payload capacity is already under way.

Less pay load, the missile breaks down into two parts with a combined weight of about 85 pounds. Payloads of 50 to 200 pounds can be put in the missile's body.

On reaching its target for delivery purposes, a parachute opens to lower the missile slowly to the ground. It lands on a shock-absorbing nose pin so that equipment in the pay load is protected. This was discussed briefly in the last issue of *ARMOR*. (See page 4.)

Predicts Seventh Decimal Accuracy

Measurement accuracy of a tenth of a millionth of an inch will probably be attained in the United States within the next ten years, it was predicted recently by Louis F. Polk, vice president and group executive of Bendix Aviation Corporation.

He pointed out that some plants today are manufacturing grinding, honing and other machine tools and measuring equipment for volume production of precision parts to an accuracy of plus or minus five millionths of an inch (six decimal places).

"But in the aircraft and missile fields, we have practical requirements for seventh-decimal-place accuracy right now," he said. "Projected piloted plane speeds of more than 4500 miles an hour and missile altitudes of up to 240,000 miles with speeds of more than 24,000 miles an hour present incredible precision requirements in making such parts as gyros, control systems, power linkages and various sensing devices," he added.

He said advanced research in such fields as nuclear energy is developing new concepts of measurement complete with new jargon. For example, he cited the estimated weight of an electron as one-thirtieth billion, billion, billion billionths of an ounce. A "jiffy," he said, is the time required for light (going at the speed of 186,000 miles a second) to travel one centimeter, a "barn," which is an area used to measure atom action, is the part of a square centimeter that would be expressed by the fraction 1 over 1 followed by 24 zeros, and a "shed" is one-millionth of a "barn."

IN MEMORIAM

(U. S. Army)

Major General Bogardus S. Cairns, Commanding General and Commandant of the U. S. Army Aviation Center, Fort Rucker, Alabama, was killed on 9 December when his light helicopter crashed in a wooded area on the post. Born in New York City on 14 February 1910, he graduated from the Military Academy in 1932. Commissioned a second lieutenant of Cavalry he served at several Cavalry posts and attended schools at Fort Riley, Kansas. While stationed at Riley, he became a member of the Olympic Pentathlon Team. In 1939 he was assigned to the 13th Armored Regiment, 1st Armored Division. He served with this unit in North Africa as Executive Officer and later commanded the 3d Battalion. He saw action in the Oran, Tunisia, Naples-Foggia, Rome-Arno and Anzio campaigns. Returning to the States in 1944, he was assigned to the War Department General Staff. Subsequent assignments included The Armor School and Headquarters, First Army. Following attendance at C&GSC and AFSC, he served as an instructor at Fort Leavenworth. Graduating from the National War College in 1952, he returned to Europe as a Combat Commander, 2d Armored Division. He next became ACS/G3, V Corps. Upon receiving his first star, he assumed command of Base Section, COMZ, France. Returning Stateside in 1955, he was assigned to CONARC. In 1957 he became the Commandant of the U. S. Army Aviation School, later the Center Commander, the position he held at the time of his death.

Well known and respected in Armor and in Army Aviation circles, General Cairns was interred at Arlington National Cemetery, Arlington, Virginia on 12 December.

Safeguards for Army's Missile Systems

Safety procedures and safeguards for the Army's air defense missile systems have been given a clean bill of health by a special civilian committee appointed to review safeguards at NIKE sites, the Department of the Army announced recently.

In a report to Secretary of the Army Wilber M. Brucker, the committee, headed by Clifford F. Hood, president of the U. S. Steel Corporation, said that "all practical precautions have been taken to provide safe operating systems." Formation of the committee was announced last October by the Department of Defense.

For its determinations, the committee visited NIKE sites at Davidsonville and Fort Meade, Maryland; the Pentagon; Armed Forces Special Weapons Project, Albuquerque, New Mexico, and the U. S. Army Air Defense Command, Colorado Springs, Colorado.

It reviewed safety features of the warheads, procedures during transit, safety features of the missile systems and procedures and command controls in use—with these findings:

1. Safety features of the high-explosive warheads for the NIKE AJAX and HERCULES are consistent with accepted techniques and practices. For the atomic warheads of the HERCULES, the Army was complimented on the very thorough and intelligent approach which has been made to reduce the hazards of accidental nuclear reaction to a remote possibility.

2. Procedures in use for warheads in transit appear to be adequate, that standing procedures for safeguards and security control are such as to minimize the risk of accidents.

3. A review of the safety features of the missile systems and inspections made of the NIKE sites at Davidsonville and Fort Meade indicates that built-in safety features, qualified operations personnel, safe methods and procedures, command supervision and periodic safety inspections all contribute to good safety performance.

4. Procedures and command controls in use are thoroughly and carefully organized and, with the exercise of constant alertness, will afford a high degree of safety.

The committee recommended that the existing program of thorough and careful training of personnel be continued with particular emphasis on careful selection of personnel, reduction of turnover and constant effort to eliminate human errors and personnel failures.

The committee also considered that the weapons systems developed by the U. S. Army are essential to the Nation's security and the elements of risk normal to the use of these weapons must be accepted.

(U. S. Army)

Depicted above is a U. S. Army mobile training team, which recently arrived in Formosa to train the Chinese Nationalist Army in modern methods of logistical resupply. Demonstrating a tank preparing to debark from the BARC, following a landing on a beach, the team, recently transferred from Fort Story, Virginia, will train the Nationalist troops in the operation and maintenance of the Army's huge barge.

Army Installations Scheduled for Closing

The Department of the Army announced recently that three installations in the United States will be inactivated.

The Department of the Army is continuing to review its installations with a view to improving the overall efficiency and economy within the Army.

Scheduled for closing by the summer of 1959—or as soon as the necessary relocation of activities can be accomplished—are Fort Polk, Louisiana; Fort Chaffee, Arkansas; and Fort Miles, Delaware. All are to be retained by the Army in an inactive status.

Active Army units now stationed at Fort Polk will either be transferred to active installations or be inactivated. The major unit at Fort Polk, Armored Combat Command A, will be moved to another installation, as yet to be determined.

Fort Chaffee is currently a U. S. Army Training Center. Training activities at this post will be absorbed by other Army training centers.

Fort Miles is primarily a firing range for conventional antiaircraft artillery units, now being phased out of the Active Army. Fort Miles will continue to be used for Reserve Components antiaircraft training.

Lightweight Aircraft Maintenance Shop

Development of new lightweight aircraft maintenance shops which can be airlifted by helicopter and maneuvered readily on the ground by a standard two and a half ton Army truck was announced recently.

The shops have been designed for use by Army Aviation units in performing light maintenance work under conditions found in field operations.

Equipped with lightweight tools and leveling jacks for uneven terrain, two versions of the shops, when fully loaded, will weigh less than 4000 pounds. One of the designs incorporates a lightweight readily detachable wheel suspension for ease in transporting the shop on the ground. The other is erected on skids. Both are equipped with rings for lifting by helicopter or crane and for towing behind military vehicles.

New Turbojet Surveillance Drone

A small turbojet and pilotless aircraft that can swoop over the battlefield to gather military information is one of the newest surveillance drones under development.

The drone, called SWALLOW and designated SD4 by the Army, will use a variety of advanced techniques for military surveillance purposes, including radar, infrared and photography.

In operation the SWALLOW will start its missions by being fired into the air from a special zero-length launcher with the aid of rockets. Once airborne, the rockets will be separated from the drone and its turbojet engine will take over. Missions can be carried out by a pre-programmed automatic guidance system or by ground or air control systems. The SWALLOW has a delta wing spread of 11 feet. An unusual feature is an air-intake duct for the jet engine, which is located under the body of the drone like a big scoop. Recovery will be done by parachute.

How Would You Do It?

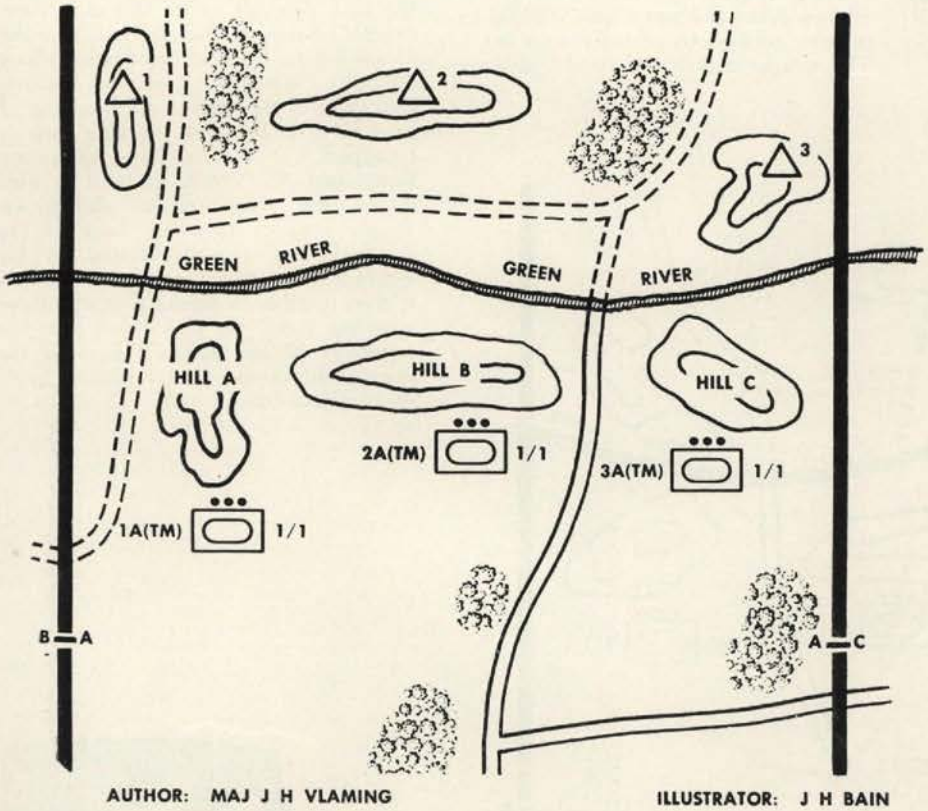
Situation. You are the Platoon Leader, 2d Platoon, Team Alfa, Task Force 1/1. Your team is part of a fixing force preparing for a mobile defense.

Team Alfa is preparing positions on Hills A, B, and C and is placing observation posts, which are to be manned by its security section, on the high ground across the Green River, 1000 yards forward of these positions. (See figure 1.) The team commander has ordered that the security section personnel carrier not be taken forward of your platoon position, which is located behind Hill B. Listening silence has been imposed, but it may be broken on the team net to report enemy movement in force.

The team commander has selected your platoon to set up the communication system for the observation posts, and has sent you the team communication chief, with three Control Groups AN/GRA-6 and a special issue of Wire WD-1/TT. You have been instructed that these observation posts are to have telephone contact with each other and with the platoon command post located in your command tank. In addition, each observation post must have facilities for radio communication on the team command net.

How would you do it?

Figure 1.



AUTHOR: MAJ J H VLAMING

ILLUSTRATOR: J H BAIN

US ARMY ARMOR SCHOOL PRESENTATION

Solution

(See figure 2.) From your three Control Groups AN/GRA-6, use three Remote Control Units C-433/GRC and one Local Control Unit C-434/GRC. Install the correct batteries in each unit, and set the BELL-LAMP toggle switch on each unit for the desired signal. Install a local control unit in the mount of your command Radio Set AN/GRC-3 and place a remote control unit at each observation post. Connect a Handset H-33/PT or Headset-Microphone H-63/U with Chest Set Group AN/GSA-6 to the audio receptacle on each unit.

At Observation Post 1, connect Wire WD-1/TT to the L1-L2 binding posts on the remote control unit and lay the wire to your platoon command Radio Set AN/GRC-3 at Hill B. Connect this wire to the L1-L2 binding posts on the local control unit installed in your radio mount. Repeat this procedure at the remote control units located at Observation Posts 2 and 3. The three wire lines from Observations Posts 1, 2, and 3 terminate at and are connected to the L1-L2 binding posts on the one local control unit at your command Radio Set AN/GRC-3.

The operator at the local control unit can operate the radio set, and he can adjust a switch on the local control unit for the type of operation desired at the remote positions.

Four-way party line telephone operation is obtainable by placing the SELECTOR switch of each remote control unit in the TEL position, and by placing the REMOTE switch in the TEL ONLY position.

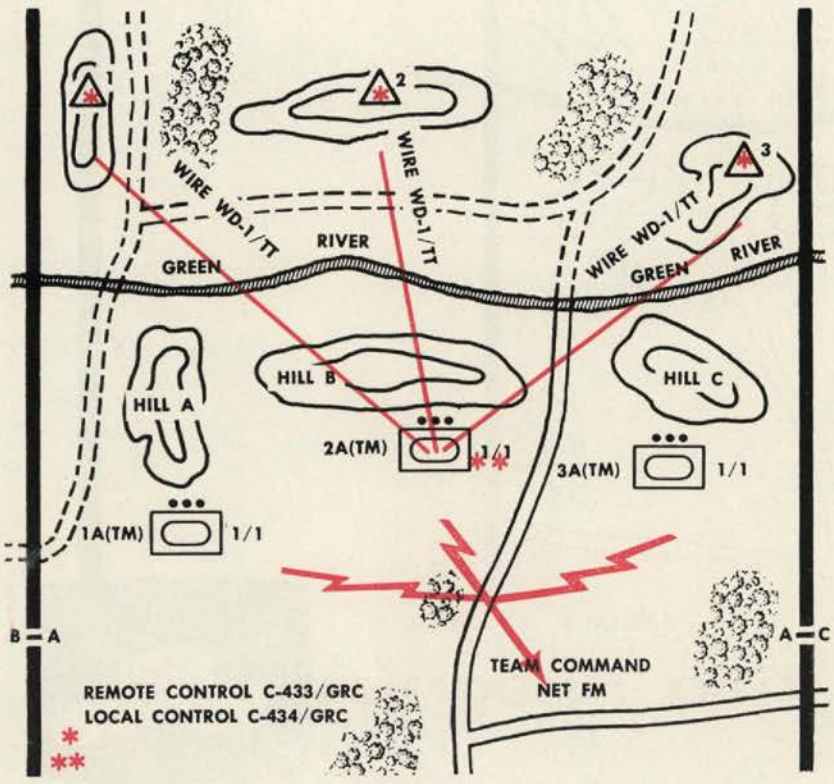
The operator at the local control unit can receive and transmit over Set 1 or Set 2 by placing the REMOTE switch of the local control unit in the SET 1 and 2 position. The LOCAL switch on the local control unit is spring loaded, and must be held in the SET 1 position to transmit over Set 1. The PUSH-TO-TALK switch on the handset (or RADIO button on the chest set) must then be depressed. Release both switches to listen. To transmit over Set 2, the LOCAL switch must be held in the SET 2 position and the handset PUSH-TO-TALK switch (or chest set RADIO button) must be depressed. Release both switches to listen.

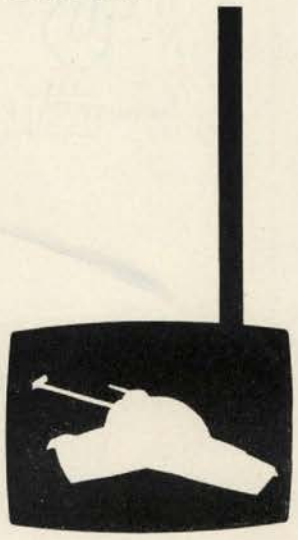
For remote operation of Set 1 or Set 2, the local operator provides this facility to the observers by placing the REMOTE switch of the local control unit on the SET 1 and 2 position. Each observer must check the SELECTOR switch on his remote control unit to determine which WRITE-IN position controls transmission over Set 1 and which WRITE-IN position controls transmission over Set 2. This can be determined by the observer placing the SELECTOR switch on an unmarked WRITE-IN position and depressing the PUSH-TO-TALK switch on his handset (or RADIO button on his chest set). The local operator determines which set has been activated, and informs the observer by telephone operation. The observer then marks the set number on the tested WRITE-IN position. The other WRITE-IN position will control the opposite set. The function of the WRITE-IN positions can be changed by reversing the field wire at the L1-L2 binding posts at the remote control unit. Each observer, in turn, must check the operation of his unit in this manner. Care must be exercised by each observer so as not to nullify the efforts of the other observers. This is done simply by monitoring before transmitting.

Also available to each observer are remote operation and control of power of either Set 1 or Set 2. A simple check with the local operator will provide this facility, if desired.

An important consideration is the manner in which the wire lines are brought to the command Radio Set AN/GRC-3 in your tank. If your tank is equipped with the Intercommunication Station AN/VIA-4, the wire must enter the tank through either the tank commander's hatch, the driver's hatch, or the escape hatch. Entry at these points offers difficulty because of closing of hatches, traversing of the turret, and snagging of loose wire in the tank. If your tank is equipped with the Auxiliary Interphone Equipment AN/VIA-1, its built in wire system has eliminated all difficulties. Simply connect the wire lines to the terminal binding posts located on the external box at the rear of the tank. It is then possible to extend a short jumper wire line inside the tank turret from the terminals of the loader's box on the turret wall to the L1-L2 binding posts on the local control unit.

Figure 2.





FROM THESE PAGES

65 Years Ago

While the use of cavalry against the other arms on the battlefield will, probably, not be so great as it was formerly, the number of cavalry battles will doubtless be much greater. The success of a campaign depending upon proper screening and reconnoitering duty, and this in turn depending upon the superiority of the cavalry over that of the enemy, each army will strive at the outset to overthrow the mounted force of its opponent. Hence, as so often prophesied, the next great war will begin with a cavalry battle of considerable magnitude. Moreover, the constant attempts to break through the screen of the enemy, and to thwart him in similar attempts, will lead to continual encounters between the screening troops, until finally, when the armies arrive within the presence of each other, the cavalry of each will uncover the front, and withdraw to positions on the flanks. From these positions, the cavalry, accompanied by horse artillery, will endeavor to gain the flanks, or even the rear, of the enemy, for the purpose of creating a diversion; and it will aid and support every attempt to attack the enemy's flank, and use every endeavor to prevent similar attacks in return. This will often lead to such great cavalry combats as those on the flanks at Gettysburg and Mars-la-Tour.

CAPTAIN ARTHUR L. WAGNER

Cavalry in Attack and Defense

50 Years Ago

The armies of the future will be made up of men untrained to war. The intelligence of the individual will be infinitely greater than of yore, and this fact will profoundly modify the course of war. The nation that, acknowledging the importance of this fact, will give all its energies in time of peace to developing the moral force of its naval and military forces, will carry off the palms of victory. This means, in a word, that the connection between officer and man must be rendered more real, more intimate. Demos has taken the scepter in hand. Discipline and democracy are not exactly harmonious notes. It will be the tact and firmness of the leader, combined with the superior intelligence of the rank and file, that will and must combine to find a solution of this apparently difficult problem. With us there should be less trouble than with most nations in solving the equation. In our army there has always been a paternal relation between the commanding officer and the men under his command. It is the company, squadron, or even troop leader, who must with us fully recognize how the fight of the future depends upon his intelligence and upon his exertions. . . . It is plain that not only will great exertions be necessary to instruct men in the art of war during times of peace, but that each arm will have to learn something of the principles that govern the attack in the other. At the commencement of a campaign in olden days it was possible to "make" soldiers in the little affairs that preceded the great battles of the war. In the future masses of men who have received but little training will be plunged, without preparation, into situations where causes of demoralization will arise that may result in annihilation.

REPRINTS AND TRANSLATIONS

The Action of the Future

25 Years Ago

Every war brings tactical changes. The World War brought the great extension in depth in the attack and defense caused by the long range and efficiency of artillery and the machine gun.

The next war for most conceivable theaters of operation will be a war of maneuver—not trench warfare with protected flanks. Maneuver requires mobility, and with the rapidly increasing system of good roads, improved motor vehicles, airplanes and radio, we will have much more mobility than heretofore; this will force the tactical changes of a far greater extension of the security elements of the main forces to front, flanks and rear, a greater demand for forces to strike these weak spots of the enemy and a greater need for mobile reserves.

While the mobility of whole armies will be greater than before, such masses must move relatively slow, and have smaller forces of higher mobility ready to make the quick thrusts or to cover the movement of the masses. Due to these increased demands, such forces must be numerous, must be capable of independent action, and also able to close with the enemy in hand-to-hand combat—in other words, be troops capable of performing the missions of Cavalry.

MAJOR GENERAL GUY V. HENRY

Address before NGOA of the State of New York

10 Years Ago

The influence of leadership on the German Armored Forces made itself felt long before the war. It consisted in a renewal of the old, well-tried basic principle of Cavalry leadership: *The leader should be well forward.* He should be so located that he can himself see what is going on, and receive directly the messages of his reconnaissance units, thus being able to give his orders rapidly. In the case of large units which march in several columns, he must be located with the most important column. He must in any case always be *in front of his reserve,* otherwise he loses all possibility of leadership.

The armored troop leader must exercise this function personally. He cannot allow himself to be represented by members of his staff. The soldier wants to be able to see his general himself. On the other hand, his staff should enjoy a certain stability, so that lateral and rearward communications and liaison may be maintained and the orders of the commander transmitted to all concerned. From this arises the necessity of separating the staff into a forward echelon, which accompanies the commander, and a rear echelon, for the transmission of orders and messages to the flanks and to the rear.

The forward or command staff echelon must be small and mobile and able to maintain itself on the field of battle. It should, therefore, be mounted in armored vehicles. . . . Mobility of leadership and the commander's presence in the midst of the fighting tank units was the first of the reasons to explain the successes achieved by the Germans. Another reason was *the concentration of the tanks in large units and the combination of these large units in armored groups* in areas of decisive importance.

GENERAL HEINZ GUDERIAN

Armored Warfare: Considerations of the Past and Future

THE BOOK SECTION

The story of German military strategy in World War II, by "the Allies' most formidable opponent."

LOST VICTORIES. By Field Marshal Erich von Manstein. Edited and translated by Anthony G. Powell. Henry Regnery Company, Chicago. $7.50

Reviewed by

Colonel Leo J. Meyer, Retired

THIS personal narrative, written by a soldier generally considered by the Germans as their ablest military leader in World War II, covers the period from the Polish campaign to his dismissal by Hitler in March 1944. When published in Germany in 1955 it attracted such widespread attention as a unique contribution to the history of the war that steps were immediately taken to make it available to the English speaking world. The translation and editing that was done by Mr. Powell is admirable, although some repetitious material could have been eliminated without detracting from the value of the book as a solid contribution to the history of the war.

Von Manstein has much to say in explanation of Germany's defeat and particularly on the disastrous effects of Hitler's strategy. Since the account is that of a participant writing without the benefit of complete records the soundness of his comments and observations is directly related to the character, memory, judgment and intelligence of the author. Based on what he has learned from his study of the records of military leaders in World War II over a period of years, this reviewer does not hesitate to rate him high on all four points. He is not one who still subscribes to the view that all writing being done by former German Generals represents a concerted effort to attribute the loss of the War to Hitler's policies in order to restore the prestige of the German military leaders. On the contrary, this reviewer considers their contributions no more biased than the average produced by American and British leaders when it comes to evaluating their own achievements, and above the average in the treatment of strategy and operations. Why a former opponent should be accused of ulterior motives for pointing out the effect

THE AUTHOR

Field Marshal Erich von Manstein, born in Berlin in November 1887, attended school in Strasbourg and spent six years in the Cadet Corps. In 1914 he joined the 3d Regiment of Footguards. Attending the War Academy in 1913-14 he saw a great deal of action in World War I. During the post-war years he held various staff and regimental positions. By 1936 he attained rank of Major General. He was von Rundstedt's Chief of Staff in the Polish campaign and held the same position in Army Group A on the Western Front. In March 1941 he commanded the 56th Panzer Corps and led an armored dash when Germany attacked the Soviets. In 1943 he took part in the last offensive to the East. Although decorated for his outstanding command ability he was relieved in the Spring of 1944.

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

Benjamin Franklin

of Hitler's policies in military matters on the outcome of the war is difficult to appreciate. No one with even a bowing acquaintance with the German records would deny that they were a factor. The German Generals who directly experienced the results of his strategic decisions and his tight control over operations are best fitted to aid the historian in determining how important a factor they were.

This is not to say that the writings of the defeated are to be taken at face value. It is merely set down to remind readers that the testimony of the German Generals is needed in reaching final conclusions and that historians have no dual standard in judging the contributions of former enemies and Allied leaders, like Eisenhower, Montgomery, Clark, Wedemeyer and a host of others, including Churchill. They recognize that no participant can be free from bias but they also know that the degree to which it is reflected in their writings varies with the individuals.

In the evaluation of this book, the fact that von Manstein by all standards of measuring military ability was no ordinary soldier cannot be discounted. He was a master of strategy and technical detail, a general who, as Liddell Hart states in the foreword to the book, "combined modern ideas with a classical sense of maneuver." Independent of mind, audacious but not reckless in battle, courageous in challenging Hitler's concept of strategy when others preferred to play safe, yet no conspirator, he is a man whose testimony must be heard with respect. Without question he was the most formidable opponent the Allies faced in the field. Had his views on strategy and the conduct of operations prevailed, it is difficult to see how Germany could have lost the war. Whenever his ideas were accepted they produced startling and tremendous success. The best known examples are to be found in the invasion of the Low Countries and France in 1940 and the conquest of the Crimea in 1941 and 1942.

Feature Reviews

Exclusive with

ARMOR

In the first instance it was he who suggested the radical change in the opeartional order that the High Command had drawn up for the immediate invasion of France after the fall of Poland. As Chief of Staff of an Army Group, he considered it basically wrong, because it seemed to follow too closely the Schlieffen plan of World War I. Even if it succeeded in working the second attempt, von Manstein held that it could at best achieve only partial victory when a quick and complete one was essential if Germany was to survive. The reasoning by which he came to the conclusion that the Allies in northern Belguim could only be defeated by shifting the weight of the attack to the left flank and launching it through the Ardennes where it was least expected is thoroughly covered in this

THE REVIEWER

Colonel Leo J. Meyer, Retired, received his BA and MA degrees from Wesleyan and his Doctorate from Clark University. A Phi Beta Kappa winner, he taught at several colleges including New York University. During World War I he served as an Infantry Officer. Between Wars he was a member of the Army Reserve. During World War II he held important transportation posts in New York Port and the ETO including CO of the 14th Major Port, Southampton. Subsequently he was Deputy Chief Historian, Office of the Chief of Military History, D/A. He was serving as Secretariat of the Transportation Board when he retired in 1955. Author of many scholarly historical articles which have appeared in academic journals, he is presently engaged in the writing of history for OCMH, D/A.

These German tanks are en route to the front lines in France in 1940.

book; so also are the difficulties encountered in persuading others to accept them. It was this selling job that gave him the most trouble. How exasperating it was, even early in the war, to convince planners who dared not differ with Hitler on strategic matters, he makes abundantly clear. That von Manstein's strategic concept prevailed was due to the conversion of Hitler himself who he concedes had an eye for tactical advantages although no appreciation for the need of long-range strategic plans.

The author attributes the decisive defeat of the Allies in northern Belgium largely to the tremendous verve with which Guderian translated the principles of his operational plan into action. Von Manstein himself played no role in this first phase of the campaign. Forced to view it from the sidelines, he is highly critical of Hitler's departure from the bold solution he had proposed to meet French counter-attacks against the southern flank of the main force. Because Hitler scrapped his scheme for a mobile strategic defense of this flank, the Germans after their victory in the north were confronted with the necessity of penetrating the French front a second time. It was in this phase of the campaign that von Manstein was able to display his ability in the field. As the Commanding General of the 38th Corps, he broke through the French lines and made the famous 300 mile assault march to the Loire River that sealed the fate of France.

Probably as a result of this military achievement, he was placed in command of the preparations for the invasion of England.

Von Manstein's concept of Operation Sealion was an amphibious assault fully supported by the German Navy and Luftwaffe. Properly timed and coordinated, he believes it had a good chance of success despite the risks involved. But sound as his views were, they were rejected and instead, Goering was permitted to fritter away the resources of the Luftwaffe in fruitless aerial attacks on British cities. On the basis of the plan von Manstein favored for bringing England to terms, the British have reason to be thankful that Hitler, rather than he, made the decisions on which their fate turned.

With the cancellation of the operation, von Manstein was given command of a mechanized corps, an assignment he had long wanted. That he would some day lead it into Russia he did not know at the time for he had not heard of any plan for invasion in the East. Logically one would have expected Hitler to consult the man who so intelligently had shaped the strategic plan that had led to victory in the West, the moment he decided to turn East. Why he did not do so is one of the puzzles in Hitler's Reich that still requires investigation and explanation. Possibly it was because Hitler sensed that von Manstein would support the strategy advocated by the Army General Staff which was basically different than the one upon which he, was insisting.

Although not consulted on the over-all plan, von Manstein had much to say about how his own command should be used initially.

Field Marshal von Manstein holding a conference before the drive on Leningrad.

German soldiers observing city of Novgorod during armored thrust on Leningrad.

It was upon his insistence that the 56th Panzer Corps was given the assignment of seizing and holding the bridges crossing the Dvina River at Dvinsk in the move on Leningrad. Always conscious of the importance of surprise and speed he made the 200 mile plunge to Dvinsk in four days. It was a power drive that in brilliance of conception and boldness of execution has few parallels in World War II. The thrust proved what von Manstein had long contended, namely, that the safety of tank units operating in the rear of an enemy depends on their ability to keep moving.

But it was as Commander of the Eleventh Army in the Crimea that von Manstein won unqualified recognition for initiative, leadership and versatility in operations. His spectacular success against overwhelming odds, he modestly attributes to the aggressive spirit and fighting quality of his troops. Important and basic as these qualities are, it must not be forgotten that it requires competent leadership to make them pay off. This von Manstein furnished to a degree rarely equalled.

The Crimean campaign was one of incessant fighting over a period of ten months. It included offensive and defensive battles, mobile and position warfare, headlong pursuit, masterly withdrawal, coalition warfare, amphibious landings, guerrilla warfare, seige operations, and in fact almost every conceivable type of military activity in which a general can expect to engage in a lifetime. Always greatly outnumbered, sometimes as much as eight to one, von Manstein met every crisis with the calmness and intelligence of a military genius. The campaign culminated in the annihilation of two Russian armies at Kerch and the fall of the mighty fortress of Sevastopol. Because of the large forces engaged and the brilliance with which the campaign was conducted it deserves to rank among the greatest of all time. Its outcome should convince the skeptical that the best German leadership when relatively free and unfettered by restrictive orders from the Supreme Command was capable of unsurpassed performance.

But freedom from interference was rare in Hitler's Germany. In explaining how disastrous Hitler's meddling was, von Manstein devotes much space, possibly too much since he himself was less exposed to it than other commanders. He first encountered its full impact as commander of the Don Army Group, an assignment he was given after the encirclement of the German Sixth Army at Stalingrad. To save the army, his plan called for an attack on the Russian ring by the Sixth Army, coincident with a northeastward assault by a relieving force. Hitler's refusal to sanction the withdrawal of von Paulus from the Volga despite the strong protest of von Manstein, Zeitzler and others condemned to death an army that could have escaped, probably as late as 23 December 1942.

Von Manstein asserts that as army group commander he ordered von Paulus on 19 December to ignore Hitler's restrictive directive and break out. That he actually issued such an

With Baron v. Richthofen at Kerch 1942 (von Manstein furthest left).

order recently has been questioned by some of the officers of the Sixth Army returning from long years of captivity in Russia. Whatever the truth may be there is no gainsaying the fact that he fought a nerve-racking battle with Hitler to induce him to reverse his "hold at all costs" order. The reason von Manstein did not chuck his job when he failed in this was his sense of responsibility and his deep concern for the safety of all the troops in Southern Russia. That he was willing to risk his head and act contrary to the orders of the Supreme Command is shown by the steps he later took to withdraw the German forces in the Caucasus, the Crimea and the Donets basin. To attempt to hold those areas after the collapse of the Volga front was to him "sheer lunacy." Probably the only reason Hitler tolerated his disobedience of orders to hold was the success he had during and after the withdrawal. Most notable was the brilliant counterstroke he dealt the enemy at Kharkov.

Some critics will charge that in stressing its disastrous effect he joins in the old refrain earlier voiced by other German military leaders. To the charge that he is making a scapegoat of Hitler, this reviewer can only reply that those who disagree with him must prove that Hitler's bungling of strategy and meddling had less effect on the outcome of the War than von Manstein and others claim. He does not believe that a critical reading of the record will show that Hitler's conduct of the war was rational. To hold that it was wise and sound to refrain from issuing long-term operational directives, to dissipate the power of the offensive by moving toward many goals at one time, to adhere stubbornly to the principle that ground gained must be held at all cost, to reject the concept of a mobile strategic defense, to meddle with the prerogatives of subordinates, to ignore advice which ran counter to what he wished to do, indicates a complete lack of understanding of the art of war. Like most students of World War II this reviewer believes that the only points on which Hitler deserves high marks are in his ability to persuade others and impose his will. Against Hitler's willpower Halder, Zeitzler, von Manstein and others struggled in vain.

The fortress of Sevastopol on fire.

Some found the battle so exhausting and the situations his inflexibility created so intolerable that they conspired to eliminate him. Among these were many of von Manstein's friends but not he.

To plot to assassinate the Chief of State was in his opinion not only a violation of his professional code but a mistake since it would lead to immediate military collapse and internal chaos. If either or both happened Germany would then face unconditional surrender and occupation by the Russians, both of which seemed to him more disastrous than putting up with Hitler. Neither the tragedy at Stalingrad nor Hitler's reluctance to sanction the withdrawal from the Caucasus and the Donets basin, which almost resulted in a worse disaster than that which befell the Sixth Army, changed von Manstein's views on the use of violent means to rectify

Sixteenth Panzer Division deploys for action during break-through to the Volga.

Field Marshal von Manstein as Commander of the Eleventh Army in the Crimea.

the command organization. One may wish that he had seen matters differently but it may well be that the conditions the Germans would have had to face in the advent of Hitler's overthrow would have been worse than those that confronted them at the end of the war. As things turned out they had to endure additional years of war and accept unconditional surrender and partial Russian occupation but they were spared the horrors that usually accompany Civil War.

Von Manstein's solution to the command problem was to persuade Hitler to turn over actual control of all military operations to a responsible Chief of Staff while retaining nominal command and to appoint a Commander in Chief for the Eastern Theater. Time and again he urged this course on Hitler despite the fact that he found it a delicate matter since he himself was the logical candidate for the post of theater commander. Hitler always listened respectfully but never acted. The reason he gave for not adopting the recommendation was that Goering would never accept it. That Goering would have objected to the elevation of von Manstein goes without saying for he hated and feared the man who often had openly expressed contempt for his judgment and actions. That the reason Hitler gave for rejecting the proposal was genuine is too ridiculous to warrant consideration. The real reason was that Hitler feared the loss of prestige and power without which no dictator can survive. Of this von Manstein was fully aware. Nevertheless he continued to press for his solution in the hope that Hitler would be forced by events to change his mind before it was too late. To his surprise Hitler finally put an end to the unwelcome pressure. While bestowing a decoration on von Manstein, one evening in March, 1944, Hitler politely informed him that the time for the grand style operations for which he was particularly qualified had passed and that he was replacing him with Field Marshal Model.

It is typical of von Manstein that he did not retire to his tent to sulk over his dismissal. Instead he spent every moment before the arrival of his successor in insuring the concentration of two armies between the Carpathians and the Pripet Marshes, a strategic move in regard to which he had forced Hitler to reverse himself shortly before. Thus ended the active career of a great military leader, a man who in many respects represented the best product of the Prussian military system and tradition. That Hitler bore his frank and at times forcefully expressed criticism as long as he did, is conclusive evidence of the respect he had for his abilities and prestige.

What the final verdict of history will be on his achievements no one can tell. It would not surprise this reviewer that when all the records are objectively compared after the tumult and the shouting has subsided, it will be that among the military leaders of World War II he alone bore the stamp of genius.

CHANCELLORSVILLE

Lee's Greatest Battle

"Fighting Joe" Hooker, confident . . . even boastful . . . his Army of the Potomac in top fighting trim, had a masterly plan to envelop both flanks of the wily Lee, the main blow to fall at Chancellorsville. Hooker's troops were deftly put in position ready to strike.

Lee learned somewhat belatedly from his cavalry where Hooker's troops were and what they were doing. Lee promptly decided not to withdraw as Hooker hoped, nor to defend as Hooker expected . . . but to attack! Lee started Jackson on his famous wide-swinging march, and the battle was on, the Confederates rolling up the Federal right flank near Wilderness Church.

Then Jackson was fatally wounded and the attack slowed. Hooker still had numerical superiority. His men were full of spirit, his leaders eager to win. But Hooker seemed incapable of aggressive action. Instead, "Fighting Joe" ordered his men back across the Rappahannock.

The incomparable Lee had yet to know defeat. His brilliant tactics and aggressive action once again had achieved victory against odds.

By EDWARD J. STACKPOLE **$5.75**

PLEASE KEEP US INFORMED OF YOUR CORRECT ADDRESS

ORDER FORM BOOKS BINDERS - *Armor*
1757 K Street, N.W., Washington 6, D. C.

Please send me the following:

_____

_____

_____

_____

_____

_____

NAME (Please Print)

ADDRESS (Street or Box Number)

CITY (Town or APO)

STATE

☐ I enclose $.....
☐ Bill me. (Members only.)
☐ Bill unit fund.

Arnhem

By MAJOR GENERAL R. E. URQUHART **$3.95**

This is the story of Arnhem, a heroic failure in the battle for control of the lower Rhine, in September 1944.

The military plan was a bold one: an ambitious airdrop using American and British divisions under Montgomery was to drive a wedge across Holland, to be quickly followed up on the ground. The prize: a crossing of the lower Rhine, isolation of German forces on the wrong side of the river, and the chance to rush through to the heart of industrial Germany, with the hope of peace by Christmas.

The most distant target was allotted to the British First Airborne Division. Their orders were to seize the bridge over the Rhine at Arnhem and hold it for 24 hours. They held it against tremendous odds for three days and three nights.

Right from the beginning the operation was beset with incredible problems. Communication was almost nonexistent, the plans of the battle were in enemy hands within two hours of the landing, reinforcements never arrived and re-supplies were dropped onto German positions. After nine days' drive back into an ever-shrinking perimeter, the First Division was called out and its survivors fought their way back across the Rhine.

The Boer War

By EDGAR HOLT **$6.00**

The first of modern wars, and yet one in which old-fashioned heroics were still practiced—such was the South African War of 1899-1902. Khaki replaced scarlet, the importance of camouflage was seen for the first time; and, by means of deadly rifle fire, and their flexible "command" tactics, 50,000 Boers defied a British Army almost ten times as strong.

Half-a-century later it is possible to throw into clear relief the incompetence of the original British command against the resourcefulness of the Boers, and to assess dispassionately the bitter controversies that the war provoked at home and in South Africa. In this short history, Edgar Holt vividly describes the fighting, and analyzes tactics and strategy; but he also closely investigates the causes and origin of the war, and never loses sight of the political background.

Henry Knox George Washington's General

By NORTH CALLAHAN **$6.00**

On a cold evening in March 1770, young Henry Knox, Boston bookseller, pushed his way through the crowd, took Captain Preston of His Majesty's troops by the coat and said, "For God's sake, take your men back." Captain Preston paid no attention. The result was the Boston Massacre, which perhaps triggered the fight for American independence, and certainly determined young Henry Knox's stand as a fervent patriot in the war that was to follow.

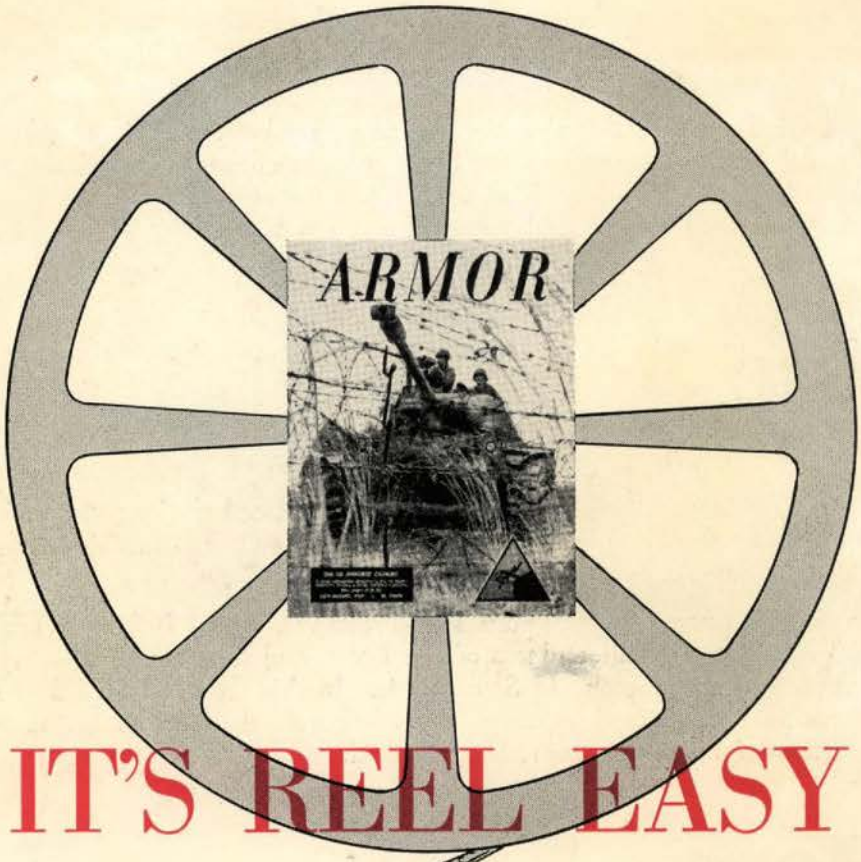
Friend of Washington, General himself, expert on Artillery and gallant fighter, Henry Knox, according to Douglas Southall Freeman, is the most important figure of the American Revolution about whom—up to now—there has been little biographical material available.

Knox was born in 1750 and went to work in his teens as assistant to a bookseller. There he read so much on Artillery that, when the Revolution started, he knew more about the subject than anyone else in this country. He was invaluable to Washington because of this, and also because, like Theodore Roosevelt, he went over or through, but never around. For example, he took many tons of cannon across the Hudson and straight over the Berkshires, roads or no roads, returning to Boston in time for his Artillery to win the Battle of Dorchester Heights.

At the end of the Revolution, Knox was made Secretary of War. In this position he supervised the plans for West Point, initiated the draft system and supervised our relations with the Indians.

Do you have trouble keeping up with the

latest information and thought relative to your branch?

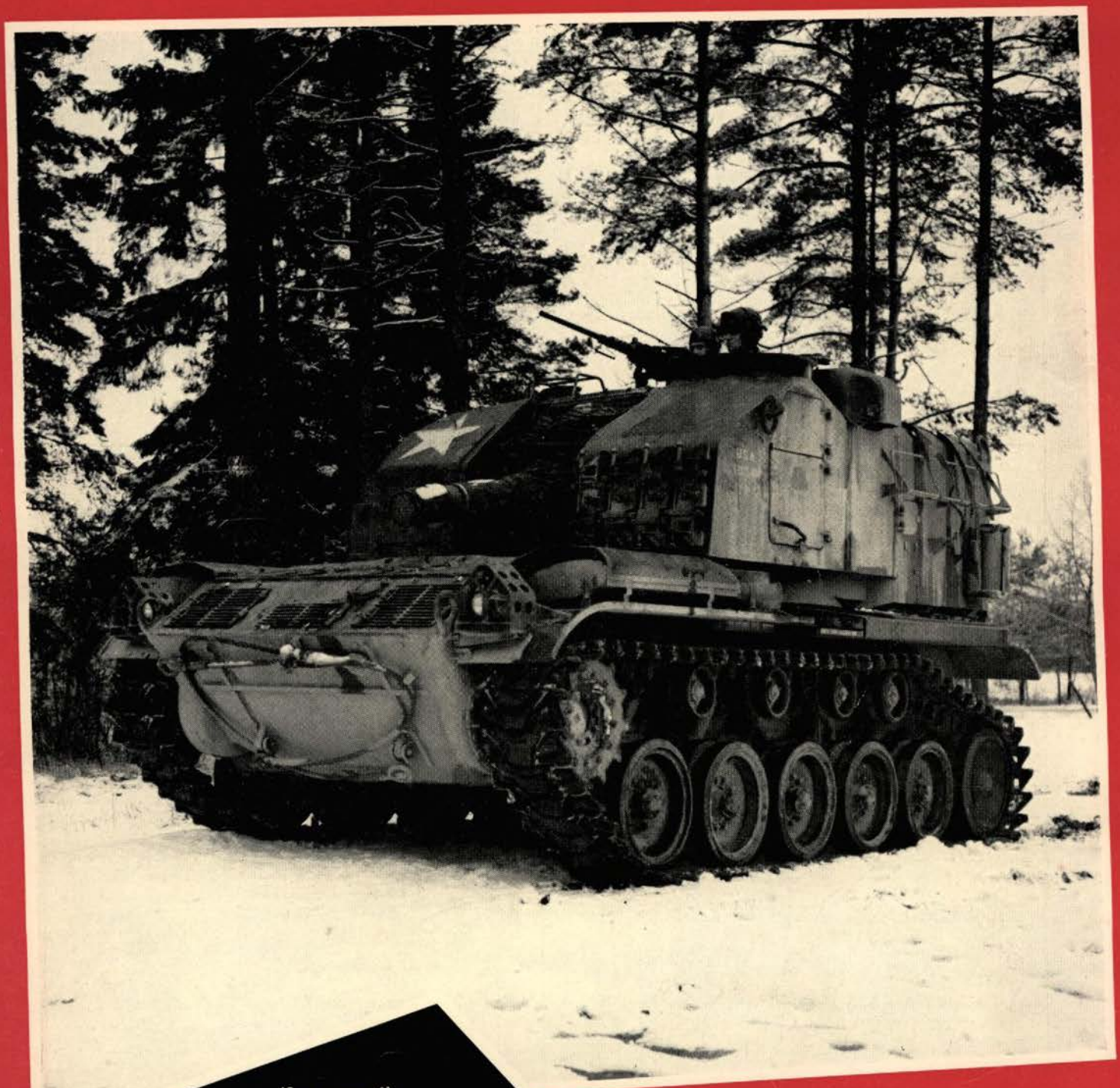


IT'S REEL EASY

Join the United States Armor Association and receive its trade journal ARMOR, *The Magazine of Mobile Warfare, published six times a year along with a NEWSLETTER during the interim months between issues of the magazine. It will take all the guesswork out of your military reading with complete coverage of mounted, mobile and self-propelled fields.*

ARMOR *The Magazine of Mobile Warfare*

ARMOR



(See page 4)

ARTILLERY IN A ROCAD DIVISION

MARCH-APRIL, 1959
80 CENTS

The Generalship of Ulysses S. Grant

A new edition of a Civil War study first published in 1929. A British military analyst views the campaigns and battles of the war and the policies and strategy of Grant.

By Major General J. F. C. Fuller **$6.50**

Swamp Fox: *The Life and Campaigns of General Francis Marion*

During the Revolution, the almost uneducated leader of a band of guerrillas held the British immobilized in South Carolina by striking and hiding in the swamps and striking again.

By Robert D. Bass **$4.50**

I Rode With Jeb Stuart

Burke Davis has edited this contemporary account of Jeb Stuart's life and added an introduction discussing the importance of this long out-of-print book.

By H. B. McClellan **$6.50**

With Sherman to the Sea: *The Civil War Letters, Diaries & Reminiscences of Theodore F. Upson*

An Indiana farm boy tells of his war experiences serving under Grant and later with Sherman. Illustrated with a few contemporary drawings.

Edited by Oscar O. Winther **$3.75**

To Appomattox:
Nine April Days, 1865

The last nine days in which Lee and his men put up a valiant but losing battle as they tried without equipment to hold back the Union forces. Story ends at Appomattox Court House.

By Burke Davis **$6.00**

The Long Arm of Lee (Reissue)

A view of the role played by artillery in the Civil War, particularly as employed by Lee's Army in Northern Virginia.

By Jennings C. Wise **$10.00**

Brave Men and Great Captains

The most dramatic exploits of Washington, Mad Anthony Wayne, von Steuben, Zachary Taylor, McClellan, Grant, Lee, Jackson and many others.

By R. Ernest & T. N. Dupuy **$5.95**

The Great Decision

A detailed account of the four months that preceded the dropping of the atomic bomb on Hiroshima and of the new problems created by the decision to use the weapon.

By Michael Amrine **$3.95**

The United States Armor Association

(Established 1885)

President
LT. GEN. GEORGE W. READ, JR.

Honorary President
MAJOR GENERAL GUY V. HENRY, Ret.

Vice Presidents
MAJ. GEN. DONALD W. MCGOWAN, NG
MAJ. GEN. JOHN L. RYAN, JR.
MAJ. GEN. WM. M. STOKES, JR., Ret.

Honorary Vice Presidents
GENERAL JACOB L. DEVERS, Ret.
GENERAL WILLISTON B. PALMER
GENERAL WILLARD G. WYMAN, Ret.
LT. GEN. EDWARD H. BROOKS, Ret.
LT. GEN. JOHN H. COLLIER, Ret.
LT. GEN. WILLIS D. CRITTENBERGER, Ret.
LT. GEN. HOBART R. GAY, Ret.
LT. GEN. ALVAN C. GILLEM, JR., Ret.
LT. GEN. GEOFFREY KEYES, Ret.
MAJ. GEN. ERNEST N. HARMON, Ret.
MAJ. GEN. JOHN C. MACDONALD, Ret.
BRIG. GEN. SIDNEY R. HINDS, Ret.
BRIG. GEN. WILLARD A. HOLBROOK, Ret.
BRIG. GEN. HENRY CABOT LODGE, USAR
BRIG. GEN. PAUL M. ROBINETT, Ret.
BRIG. GEN. HARRY H. SEMMES, Ret.

Secretary-Treasurer
LT. COL. WILLIAM H. ZIERDT, JR.

Executive Council
GENERAL BRUCE C. CLARKE
LT. GEN. CLOVIS E. BYERS
MAJ. GEN. HOMER O. EATON, JR., NG
MAJ. GEN. ROBERT E. FRANKLAND, NG
MAJ. GEN. LOUIS V. HIGHTOWER
MAJ GEN. ALBERT S. JOHNSON, NG
MAJ. GEN. HARRY W. JOHNSON
MAJ. GEN. W. P. JOHNSON
MAJ. GEN. ALMERIN C. O'HARA, NG
MAJ. GEN. ANDREW P. O'MEARA
MAJ. GEN. ROBERT W. PORTER, JR.
MAJ. GEN. MAXWELL C. SNYDER, NG
MAJ. GEN. THOMAS E. VAN NATTA
MAJ. GEN. EDWARD O. WOLF, NG
BRIG. GEN. CHARLES G. DODGE
BRIG. GEN. JAMES I. KING
BRIG. GEN. HAL C. PATTISON
BRIG. GEN. W. H. S. WRIGHT
COL. FREDERIC W. BOYE, JR.
COL. ANDREW J. BOYLE
COL. JAMES H. CRITCHFIELD, USAR
COL. SAMUEL MCC. GOODWIN
COL. LAWRENCE V. GREENE
COL. WILLARD WEBB, USAR

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR
Lt. Col. William H. Zierdt, Jr.

BUSINESS MANAGER
M Sgt J. William Joseph

ASSISTANT TO THE EDITOR
Sfc Michael E. Kekker

CIRCULATION MANAGER
M Sgt William Coley, Jr.

Volume LXVIII MARCH-APRIL, 1959 No. 2

CONTENTS

LETTERS TO THE EDITOR 2

ARTILLERY IN A ROCAD DIVISION 4
By Brigadier General William F. Ryan

THE M60 MEDIUM TANK 12

THE ANNUAL REPORT OF THE SECRETARY-TREASURER-EDITOR 14

CHARIOTS——THE FIRST COMBAT VEHICLES 17
By Richard M. Ogorkiewicz

EDITORIAL 22

TOWARD BETTER ARMOR TRAINING MANAGEMENT 24
By Dr. Robert A. Baker

THE 1958 ARMOR LEADERSHIP AWARD 31
By Lieutenant Colonel Robert J. Bennett

TRAINING AN ARMY NATIONAL GUARD ARMORED DIVISION 35
By Major General Clayton P. Kerr

RECONNOITERING 42

GASOLINE ECONOMY FOR ARMOR 44
By Howard C. Olson

REVISIONS TO ROCAD 48
By Colonel John A. Beall

NEWS NOTES 52

HOW WOULD YOU DO IT? 55
A U. S. Army Armor School Presentation

FROM THESE PAGES 57

THE BOOK SECTION 58

ARMOR COMMAND 58
Reviewed by Brigadier General Sidney R. Hinds, Retired

NUCLEAR TACTICS, WEAPONS, AND FIREPOWER IN THE PENTOMIC DIVISION, BATTLE GROUP, AND COMPANY 59
Reviewed by Lieutenant Colonel Robert B. Rigg

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and editorial offices: 1757 K Street, N.W., Washington 6, D. C. Copyright 1959, by the United States Armor Association. Second-class postage paid at Washington, D. C. and at Additional Entry. Terms: Domestic subscriptions, including APO's, $4.75—one year and $8.00—two years. Foreign, including Canada & Pan America, $5.50—one year and $10.00—two years.

LETTERS TO THE EDITOR

The January-February Cover

Dear Sir:

It was with great interest that the members of this battalion noted your cover for the January-February issue. Although you passed off the effort as a casual snap of your staff photographer I think you know that the photograph was the result of your personal letter to the Armor Center. Final action for the equipment and personnel devolved upon the 3d Medium Tank Battalion (Patton), 33d Armor, Lieutenant Colonel James W. Cavender, Commanding. This battalion is one of six battalions that make up the U. S. Army Armor School Troops, a composite unit devoted to the mission of supporting Armor School instruction with men, tanks and equipment, and in no less a vein "blood, sweat and tears." In addition and where required we also support other government agencies located here such as the Armor Board and the Human Research Organization.

Since the picture appeared as the cover plate of our favorite magazine (indeed, it appears in the dayroom of every company in this battalion) we are taking special pride in the fact that they are our tanks which are shown. We do feel, however, that for a magazine devoted to informing our brothers-in-arms about Armor we were slighted inasmuch as nowhere did you mention our unit designation. We who work in School Troops are something like actors—we suffer when we get poor or few press notices, and conversely we rejoice in favorable attention. When you consider that hardly a class passes through the Armor School that does not see some portion of the 33d Armor in action, you know that we strive for perfection in our achievements and we appreciate recognition of our efforts. We are proud of our part in making armor tactics and techniques a living thing for the many students of Armor and the hundreds of official visitors that visit Fort Knox each year.

We responded promptly to your call for this picture for this fine issue of Armor—please do us a favor—may we have a copy of that photograph in color, and suitable for framing (approximately 8½ x 11½) which we would like to hang in our trophy room? Remember, we're counting on you.

MAJOR DANIEL B. CULLINANE, JR.
Executive Officer
3d Medium Tank Battalion, 33d Armor
Fort Knox, Kentucky

● *We apologize for the slight to the 3d Medium Tank Battalion, 33d Armor for not giving them due recognition. Actually we pieced together three photographs to get the desired effect for this duo-tone cover. Two of the three shots were taken at Knox. We are well aware of the accomplishments of the School troop units which do so much to make the U. S. Army Armor School outstanding in its specialized field world-wide and outstanding among all U. S. Army service schools. Personnel at Fort Knox have always fulfilled our requests. Incidentally at the present time the artwork has been loaned to another school for depicting Armor in a forthcoming publication. As soon as it has been returned we will get the reproduction at least in black and white.* ED.

Armor Command

Dear Sir:

I have noticed the advertisement in the January-February 1959 issue of *ARMOR* of the book entitled *Armor Command.*

The brief statement concerning the contents of the book was taken from a statement made by Lieutenant General William K. Harrison, Retired. You will note that this is included in the foreword to the book. I would suggest that in the future the origin of such statements be indicated by use of quotation marks and giving the author's name.

BRIG. GEN. P. M. ROBINETT, Ret.
Mountain Grove, Missouri

DOD Reorganization

Dear Sir:

I enjoyed very much the informative and timely article entitled *The Reorganization of the Department of Defense* by Lieutenant Colonels Waters and Rogers, that appeared in the January-February issue of *ARMOR*. I would like however, to call your attention to an error that appeared in the chart on page 20 showing the organization of the Joint Chiefs of Staff.

The box indicating the title of the U. S. Military Representative should read, "U. S. Military Representative to the Military *Committee,* Military *Committee* (P.S.), and Standing Group, NATO (not military Commission, etc.).

Keep up the good work.

COLONEL MAURICE E. KAISER
Secretary,
Military Committee and
Standing Group—NATO
Washington 25, D. C.

Lost Victories

Dear Sir:

Congratulations to Colonel Leo J. Meyer on his excellent book review which appeared in the January-February issue of *ARMOR*. (See page 58.) This outstanding review gives the reader a clear picture of the book *Lost Victories,* and an insight into the man, von Manstein, who I consider one of the best, if not the top General in the German Army.

JAC WELLER
29 Palmer Square West
Princeton, New Jersey

For Better Communication

Dear Sir:

Upon reading your problem, *How Would You Do It?,* in the January-February 1959 issue, I decided that one addition to the given solution might well be used. Because of the possible disadvantage of all communication points (the local control C-434/GRC and the three remote control groups C-433/GRC) having to answer their phone every call, I suggest that a SB/18 be utilized in the following manner. One end of a short length of wire WD-1/TT could be attached to the L1-L2 binding posts on the local unit and one end to a jack of the switchboard. Similarly, wires from each of the O.P.'s would be attached to three additional switchboard jacks. The SB/18 would be utilized in the normal manner.

By doing this, individual calls can be

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1959 by the United States Armor Association.

Reprint Rights: All Rights Reserved.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of Armor is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1757 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the even months of the year: *i.e.,* Dec. 25 for Jan.Feb issue, Feb 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

made without causing all O.P.'s to answer their phones. Also, each O.P. can then operate the radio at the command tank without disturbing the others. Four-way party line telephone operation is obtained simply by connecting the four jacks together.

LIEUTENANT WILLIAM S. CLOUGH
Company D,
3d Medium Tank Battalion, 32d Armor
Fort Stewart, Georgia

An Armor Booklet

Dear Sir:

I have always felt that we should use every device we can to further interest in Armor. I have a suggestion along this line, and I believe The United States Armor Association is the proper agency to do the job.

I suggest that a notebook be published for Armor personnel—particularly for the benefit of our junior leaders. Such a notebook could include historical items for maintaining interest in our fine traditions, practical hints and aids directed primarily toward Armor problems, and some general information similar to that in the Army Mutual Aid Association notebook.

The Armor notebook could be patterned generally after the one which was formerly published by the Infantry Journal; but it should contain carefully selected information and be designed in such a manner that every man in Armor will be proud to own one.

Perhaps it would be advisable to mention this proposal in *ARMOR* and conduct an informal poll to determine if this would be a worthwhile project. The idea is the main consideration.

MAJOR WARREN C. EASTHAM
Hq, 1st Bn, 34th Armor
Fort Lewis, Washington

Training and Fire Commands

Dear Sir:

In reading the article *Crew Reaction Training* in the November-December issue of *ARMOR*, I was deeply impressed by the emphasis being placed on the transitional training between advanced individual and basic unit training in Armor. The training devices and procedures developed by the personnel of the U. S. Army Training Center, Armor to assist in the accomplishment of the task, shows a high degree of interest and initiative.

The comments I have are not in any way meant to detract from the article, but, on pages 12, 13 and 14, where the trainee tank commander issues his initial fire command, elements of the fire command appear to be in error. The situation takes place in an M48 tank and with all fire control equipment operational, the initial fire command should contain only four elements; *i.e.*: Alert—Ammunition—Target Description—Command To Fire. The range is omitted because we have a range finder. In all examples shown, the range has been included. My question is—Why? If the authors have included it for some specific purpose not explained in the article, my profound apologies please.

CAPTAIN CHESTER A. WOODS
Weapons Department
TUSAARMS, Fort Knox, Ky.

Rapid Refueling

Dear Sir:

In your May-June, 1958 issue there is an article on Rapid Refueling in which the author advocates the replacement of the five-gallon petrol can (known over here as the Jerrican) by the 1200-gallon petrol tanker.

His arguments however fail to convince myself and some friends with whom I have discussed it. Our objections can be listed under three headings:

1. Time Saving
2. Tactical
3. Vehicle Maintenance

Time Saving

One tanker can refuel six tanks. The petrol required for this number of tanks can also be carried in jerricans in one 2½/3 ton truck.

In the best possible conditions, that is when the tanks can be driven up to the tanker two at a time, it can refuel its six tanks in 20 minutes. (3 pairs of tanks at 5 minutes each, plus five minutes allowance for the time taken in breaking out delivery hoses, starting the pump and changing the hoses from one tank to another.)

Under the same conditions the can refuelling of six tanks could take place on all six simultaneously and would therefore take twenty minutes as well.

There is thus no time saving at unit level.

Tactical Conditions

Under conditions of modern war it is most unlikely that the demands of concealment would permit refuelling two at a time. It is much more likely that the tanker would have to visit each tank in its own location, thus doubling the time taken and therefore causing a time-loss during refuelling compared with the can refuelling system.

Cases will arise in which the tank, because of its better cross-country performance, will be in a position which the tanker cannot reach. At one time in Korea we had 16 tanks in our battalion area and could not have placed a 2½/3 ton tanker within 50 yards of any of them. In such cases the choice lies between hand refuelling by can or driving the tank out and creating extra tracks which would need to be concealed.

A 2½/3 ton truck used for petrol supply can, when necessary, dump its petrol cans and be used for other loads. A tanker on the other hand can carry only petrol. The introduction of the petrol tanker therefore means that, either the unit commander has lost some flexibility in his transport, or some extra trucks must be added to his establishment.

Vehicle Maintenance

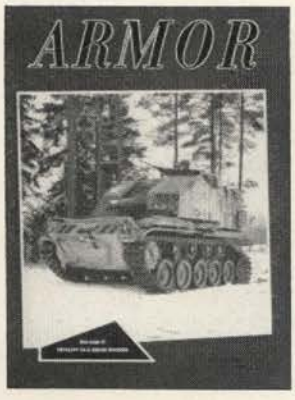
Under field conditions the maximum standardization of vehicles is called for. The more types, the greater the variety of spares necessarily carried, and the more difficult the task of the unit mechanics.

The introduction of the petrol tanker even if built on a standard chassis, and with a standard engine, will mean new types of spares. However, this is a comparatively minor objection compared with those above.

Conclusion

For these reasons I prefer the five-gallon can for refuelling the actual tank or vehicle at unit level. I must add, however, that my friends and I consider the petrol tanker has great advantages over both the five-gallon can and the 40-gallon drum for moving petrol from pipe line head or base installation to the Divisional Petrol Point.

CAPTAIN R. M. SETON-BROWNE
Royal Leicestershire Regiment
Shrivenham, Swindon
Wilts, England



THE COVER

The U. S. Army photograph used for this cover shows an M44 self-propelled artillery piece. To be effective, artillery must be capable of moving and communicating over great distances and of delivering fire quickly when called upon. In addition, it must have an acceptable degree of protection from the enemy.

Sometime ago your editor wrote to the Fourth Armored Division in Germany and asked them to do a piece for us on the aspects of Armored Artillery in a ROCAD Division. The following article is the fruit of that letter.

Although changes have been made in ROCAD, we feel that this article is must *reading for every mobile minded artilleryman who is affected by the new organization.*

(U. S. Army)

ARTILLERY in a ROCAD Division

By BRIGADIER GENERAL WILLIAM F. RYAN

DEAR Bill: You have asked me for my thoughts on the artillery in the new armored division. Because I am living with it every day, it is a bit difficult to pick a starting point. If only we could get together for a "shop talk" session, the words would come more easily and the entire picture would fall in place. However, because what I have to say may be of interest to others, I am only too glad to put some of my thoughts on paper.

In the first place, as I try to evaluate the problem, my mind jumps back a quarter of a century to the day that well known artilleryman, Brigadier General Manus McCloskey, lined us cadets up on the picket line and after insuring that everyone in the group was looking him in the eye "so that we might have a meeting of the mind," informed us "The quintessence of an artilleryman is agility of action and agility of mind." The old boy was thinking of pack and horsedrawn artillery at the time, but what he had to say is far more important today than it was the day he said it.

Considering the equipment available to us today, the artillery in an armored division is quite well organized. Of course, we could use several more people here and there and some modification of the TO and E. Many people, I am sure, will consider changes in these areas of major importance. They may be, but I prefer to keep my eye on bigger and to me more important things. TO and E's can be modified most any time and while the Army is being subjected to some arbitrary cuts in strength, the artillery must expect to take its share of cuts. What I hope will happen is that the Department of the Army will provide us with a wartime augmentation in those areas where we know we are below strength for continuous operation. This would amount to about a 10% increase in the strength of each battalion. Since there is little or nothing we can do about the matter at present, I would like to pass on to some areas in which we can do something to increase the effectiveness of our armored artillery.

From the day we started preparing for our battery tests at Fort Hood, it was obvious to all that neither the battery nor the battalion test was designed to prepare armored artillery for combat. The prescribed tests 6-1 and 6-5 have been slowed down so that they now provide a vehicle by which a mediocre outfit can achieve a high score if it has a well trained, conscientious cadre to do the work and sufficient fillers or warm bodies to flesh out the outfit. Any test of armored artillery must go well beyond this and must test the unit's ability as a whole. It must determine whether the outfit will hold together under stress when each individual is required to do his job correctly the first time whether or not his supervisor is directly controlling his efforts.

At this point I would like to digress for a moment and give you my concept of the job that will face armored artillery in the next war. To start with, both sides will use atomics throughout or we shall fight under the constant threat of nuclear weapons. I do not believe we shall witness the indiscriminate use of very high yield weapons throughout the world for even the most shallow pseudo strategist is aware that in such a war neither side can win. As I see it, each side will use the weapons available to it to its best advantage as the situation dictates. The Soviets have exhibited a penchant for slave nations and cannot be expected to suddenly change their philosophy and strive for a world covered with desert and populated by the ghosts of people who might have been made comrade workers. On our side, I am certain we shall retain our humanitarian approach to war and seek to destroy the enemy's armed forces and their immediate supporting bases. In such a setting, we cannot again engage in war with fixed lines and large fixed bases. The enemy can destroy any one or several parts of our structure at will, but unless he destroys the entire continent, he cannot destroy our cohesive fighting forces. In the future, we should not envision combat as taking place on a battlefield. It will take place in a battle area and the size of the area I leave to you. Some strategists have pictured the areas as being 200 miles in depth. I think this is too shallow.

BRIGADIER GENERAL WILLIAM F. RYAN, a 1933 graduate from USMA, was commissioned in the Artillery. During World War II he served in Europe where he commanded the 402d Field Artillery Battalion, 42d Infantry Division. Attending C&GSC in 1948 he was assigned to the Army General Staff. Graduating from the Air War College in 1950 he remained there with the Advisory Group. In 1953 he went to Korea as Executive Officer IX Corps Artillery, later G3, Eighth Army. Returning Stateside he was assigned as Director of Development, D/A. Next he was assigned to the Armed Forces Special Weapons Project, Sandia Base prior to his present assignment as CG, 4th Armored Division Artillery.

Initially, of course, there may well be a clash of major size units, but once nuclear weapons come into play, both sides will be forced to operate with small, independent or semi-independent forces of about combat command size. Each such force must have an organic nuclear capability or must be capable of calling for long range nuclear support. In either case, the nuclear support must be immediately responsive; it must be placed on designated targets in a matter of minutes. I will have more to say about this later.

Regardless of the number of types of nuclear weapons used, we shall continue to have a need for conventional artillery. To be effective, the artillery must be capable of moving and communicating over great distances and of delivering fire quickly when called on. In addition, it must have an acceptable degree of protection from effects of atomic weapons.

With this hasty treatment of the background in which we may expect to fight, what have we done to prepare armored artillery for such a conflict?

As you are well aware, once an artillery outfit has completed its basic training, it starts training for its battery and battalion tests. If these tests are properly designed, the artillery will devote its time to training in accordance with the proper concepts. Our first step was to redesign the battery tests. Fortunately, there were a few of us left who recalled the original Battery Test I. We patterned part of our battery test on it. In the first place, we eliminated any requirement for wire communications. We can and must operate with radio alone. Our forward observers were mounted in tanks and moved forward as part of an advance guard. Actually, all our forward observers were required to take the tank commanders' orientation course at Vilseck in order that they might be fully qualified as tank commanders. The smarter observers found that they had acquired some invaluable tools in the tank range finder and the azimuth indicator. During the test, the tanks were moved forward on flat ground immediately adjacent to the impact area. This shaved the safety regulations pretty close, but men were required to wear helmets and flak jackets and were required to remain in the tanks throughout the test. Only head and shoulders were exposed. I can assure you that after several sessions on the edge of the Grafenwoehr impact area, there is no longer a requirement to send any of these men through the infiltration course. Nor is it necessary to explain to the men why they are required to wear helmets and flak vests. Fortunately no one was injured, though we had rounds from unknown sources detonate behind the forward observer parties.

(U. S. Army)

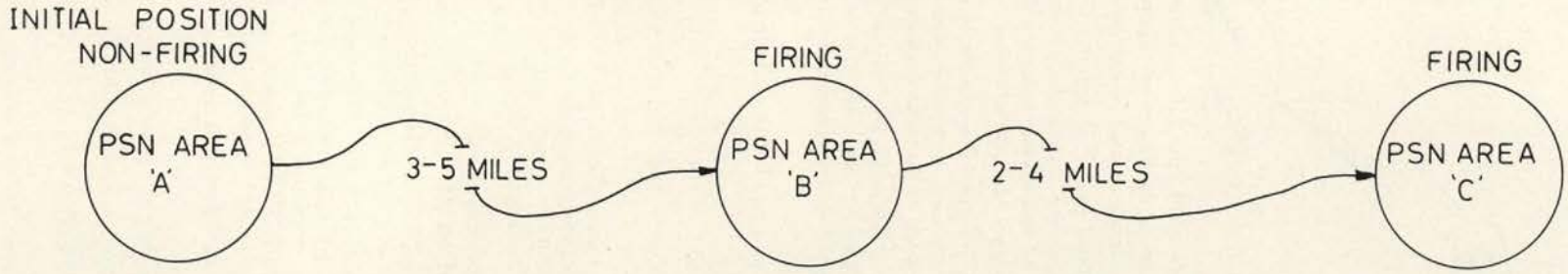
In redesigning our battery tests we had our forward observers mounted in tanks.

Batteries received fire missions while moving with the advance guard and were required to pull off the road and shoot *now*. In the test, we allowed five minutes from the time the first track stopped until the first round was fired. We found that we could have reduced this time since the batteries tested had the first round on an average of three and a half minutes. This was sufficient time to do the job carefully and to preclude the introduction of gross errors. In a combat situation, most batteries could have fired more quickly. Our best time was 50 seconds. As in all tests, the smart people read the rules. Some of the executives laid as many of the pieces as possible before firing. Some held stop watches and gave the command to fire four minutes and 50 seconds after the first piece stopped in position. In combat I am certain that a well trained battery can start adjusting in an average of not more than one minute after the first piece stops.

We had no time out for safety. This is an item that has been of concern to me ever since the day a lieutenant asked me why we did not have safety officers on the T/O since we apparently needed them in peace or war. In any event, safety time out destroys any sense of urgency on the part of our gun crews. The "hurry up and wait" philosophy has done more to destroy realistic artillery operations than anything else I know.

At each position we staked out a bay with engineer tape and set our safety stakes before the battery arrived on the position. I know your first reaction will be that we gave the batteries an advantage by doing this. It did not work out that way. Division Artillery prescribed certain basic formations for batteries: Star, running W or hexagon. Each battery was allowed to designate the type of formation it preferred within these limits.

When a battery arrived in the vicinity of a firing position, a forward observer transmitted a fire mission. The executive officer with several men on his vehicle moved out rapidly. The column was not allowed to slow down. Generally the executive had approximately one minute at the position before the battery arrived. About all he had time to do was to



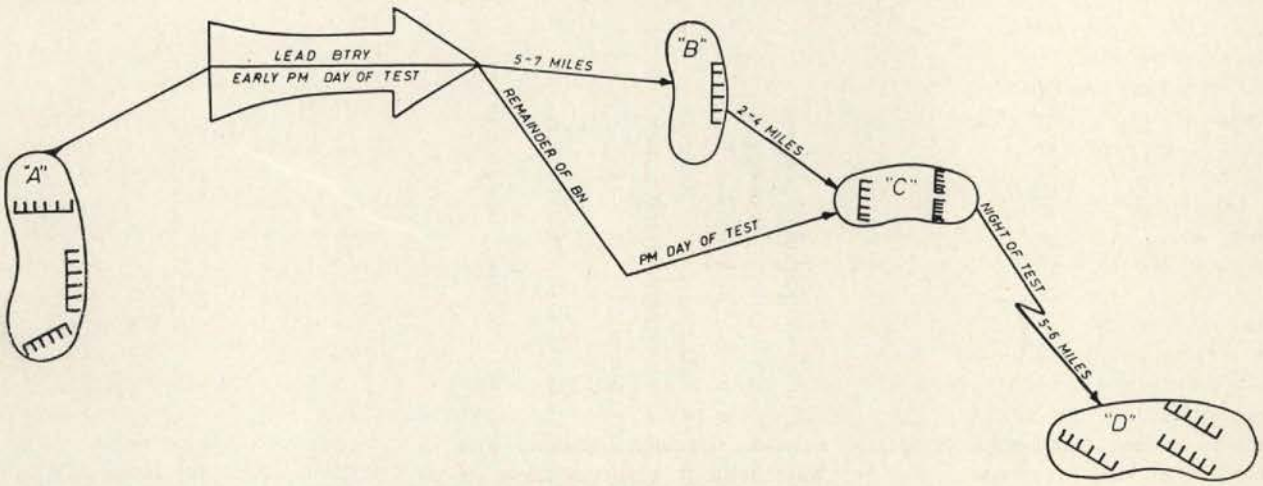
EVENTS

1. Position area and initial tactical situation given to battery commander on day prior to test.
2. Moves into and organizes position for perimeter defense. Prepares to deliver fire.
3. Computes MET and VE data.
4. Receives orientation and orders by chief umpire.
5. Issues instructions and orders to battery.
6. Battery commander moves forward with chief umpire.
7. Battery initiates movement forward on order.
8. Observers are oriented in forward positions.

1. Battery makes hasty occupation of position and delivers fire on 3 targets of opportunity in rapid succession.
2. Battery moves forward to position "C" on order of battery commander.

1. Battery makes a third occupation of position and delivers fire on a fourth target of opportunity when directed by chief umpire. This problem may be indicated to the observer at any time after movement of the battery is initiated from position "B."
2. Registration conducted to include time K.
3. K-transfer fired on previously designated "on-call" target.
4. Critique.

Armored Field Artillery Battery Test.



Armored Field Artillery Battalion Test.

PHASE I

1. At 0700 (or at daylight) on the day of the test, chief umpire meets Battalion CO in vicinity of position area "D." Tactical situation and mission given to cause battalion to prepare for a night occupation of position "D." Situation and orders cause Battalion CO to move battalion into position area "A." Prepare to fire in support of a force and prepare for local defense in any direction. No firing will be conducted from position area "A."

2. At orientation in position area "D," only survey officer and selected staff will attend. Battalion CO will issue instructions to initiate survey and preparations for occupancy of position "D" after darkness. Battalion CO will issue instructions for battalion to be in position area "A" by noon on day of test. Umpires grade for local security, etc., in area "A" beginning at noon on day of the test.

3. Tactical situation given by chief umpire will cause all FO Sections except 2 to join infantry or tank company's (umpires) by noon. Two observer sections will be permitted to recon OP's forward of position area "D" on AM of test. Survey party completes survey of position area "D" by about 1400 on day of test. Allow 6-7 hours.

4. Six hours prior to darkness, new tactical situation given to Battalion CO. Requires battalion to take up approach march formation to meet an unexpected enemy threat. One battery will take up position in advance guard of the combat command. Remainder of battalion is 4-6 miles in rear in march formation. FO's in tanks or APC's are with infantry or tank company's (umpires). Air OP is active. Survey is complete in position "D" and target area forward of area "D."

PHASE II

1. Tactical situation presented by umpire causes leading elements of supported force to meet opposition. As leading battery of tested battalion nears position area "B," umpires identify two targets, one to the air OP and one to an observer in a tank on the ground. Leading battery makes a hasty occupation of position and delivers fire on these two targets of opportunity.

2. While targets in 1 above are being attacked by the lead battery, the chief umpire presents a tactical situation to the Battalion CO to cause the remainder of the tested battalion to move forward without delay and occupy positions in area "C."

3. When the two rear echelon firing batteries enter position area "C," two targets of opportunity are given to observers by umpires. The firing batteries will be required to make a rapid occupation of position and attack the targets of opportunity. Battalion CO may recall survey personnel from position area "D."

4. Concurrent with firing two targets of opportunity in 3 above, a third target of opportunity is designated to an observer. The battery in position area "B" will attack this target—all firing batteries are firing simultaneously at different targets.

5. Upon completion of the firing in 4 above by the battery in area "B," the Battalion CO will cause it to move forward and occupy position with the remainder of the battalion in area "C."

6. On arrival in area "C," a rapid survey of position area is initiated to locate the batteries—1:25,000 maps may be used. Upon completion of the firing in 3 above one battery will conduct a registration.

7. An adjustment is made on a target of opportunity and battalion massed for effect.

8. Battalion fires an "On Call" K-transfer.

9. An adjustment is made on a target of opportunity by 1 battery using high angle fire.

10. New tactical situation presented to Battalion CO 2 hours prior to darkness to cause the battalion to make a night occupation of position in area "D" that was previously selected and survey completed during the morning.

PHASE III

1. Battalion moves under cover of darkness and occupies positions in area "D."

2. Upon occupation of position and at a time designated by the umpire, a MET and VE mission is fired—1 Battery Concentration.

3. High Burst Registration is conducted.

4. Illumination mission fired—Surveillance made on 5 below.

5. "On Call" battalion mission fired with remaining two batteries.

6. Battalion Concentration fired on restituted target.

7. Center of Impact Registration conducted after daylight.

8. Battery Concentration fired on a target located by Battalion Survey Base.

9. Battalion TOT fired on an "On Call" mission.

10. Critique and termination of exercise.

16 Problems
Estimated Ammo Exp—250 Rounds

set up his aiming circle and designate a direction of fire. When the howitzers arrived at the position, they drove to proper relative positions, guiding on the battery executive, or they followed the guides the executive had brought forward.

The bays we had installed were a hinderance in as many cases as they were a help since in deep grass many of the howitzers had to hunt for theirs and thus lost valuable time. Five minutes after the first piece fired the entire battery had to fire for effect or credit would be lost. I can assure you that no one from a gun battery needed calisthenics or speed marches to keep in shape.

The battalion tests were patterned along the same line. One battery moved out with the advance guard and was used to attack targets of opportunity which were called in by air or ground observers while the battery was moving. The remaining two batteries marching with the main body were each confronted with similar problems. After the initial targets had been attacked, the battalion was closed in the position occupied by the two batteries. After dark the entire battalion moved tactically to previously surveyed positions and executed the normal missions found in ATT 6-5.

As in the battery tests, the forward observers were in tanks or aircraft. One of the big advantages of this test is the fact that it moved rapidly from start to finish. The battalion occupied a firing position rather than a hide position during the morning of the test. The movement started about four hours prior to darkness and from that time on everyone in the battalion had to stay on his toes in order to do his job right the first time.

As a result of these tests, we find that well trained batteries and battalions held together during the stress of fast movement. Some units we thought looked good fell apart with "Rube Goldberg" communication systems or rigid SOPs. Only an outfit in which everything was good in all departments could get by. Initially, communications within the firing batteries caused us major difficulties. This problem was licked by intensive training and by augmenting our communications with the eight PRC 6's normally issued to forward observers.

So much for our tests. We have made a couple of other innovations. We have formed a provisional Target Acquisition Battery. We placed in this battery the Division Artillery survey section and the metro section. From each battalion we moved in one survey team and the radar section. The battery was tested in December and did very well.

We have found that with the existing map in Europe, battalions can normally get by with one survey crew though the battalion commanders are still reluctant to go along with this view. If a battalion needs survey assistance, Division Artillery can always send it a survey crew or we can provide a battalion complete survey of any position we may order it to occupy.

Our radar people were completely stymied for training when their radars went out of commission. I can assure you that this is not an infrequent occurrence. With all the radars pooled in one battery, we are certain of at least one remaining operational and our training continues in spite of all technical difficulties.

We were more than happy to have the people from Fort Sill advocate a Target Acquisition Battery for Division Artillery during the Artillery Conference in Frankfurt. We feel we are somewhat ahead of them since we have our battery in being. One thing I must admit; we referred to our organization as the Observation Battery until we heard the Sill presentation—we agree the name should be the Target Acquisition Battery. We have no special electronic devices or drone aircraft to help us locate targets as yet, but when such devices become useful and available, we will be organized to handle them.

When we first arrived in Germany, we were very much disappointed in our radio communications. We now feel we have the problem pretty much licked. There were two basic causes of trouble. In the first place, we had not adequately tested the radio components and eliminated those parts that indicated deterioration. If the sets worked when we established a net, it was assumed they would continue to work when we went to the field. They did for a short time but components failed at such a rate we were often faced with communication breakdowns. In the second place, we have had to sight our radio on high ground and use strategically placed relay stations. Both of these means are clearly stated in the book, but one has to operate in the field before all concerned are convinced.

Speaking of communications, we move great distances here and cover wide fronts in all our exercises. Division Artillery must be able to remain in contact with all its battalions all the time. During a maneuver, of course, we can split the CP, but time after time after a long move it was 10 to 12 hours before we could close and be fully operational in a new area. To solve this problem we have devised a helicopter borne CP which enables us to move quickly and effectively.

A short time ago we were ordered to have a CP set up in a location 100 miles from our Kaserne in order that we might participate in an exercise. Since there was no previous notice, it required an hour to get an H34 helicopter to our location. In the meantime, personnel to man the CP were being rounded up. Two hours after we were notified, the Division Artillery CP was set up and operating 100 miles from its home base.

The CP consists of two AM, two FM radios with 292 antennas, tentage, tables, chairs, maps, generators, gas, water and food sufficient for 24-hour operation, and eight personnel. H34s are not easy to come by and so we devised a system whereby we would require the service of only one and would require it for only the flying time between CP locations. All the CP equipment is loaded in a metal basket, about 6′ x 6′ x 2′, made from old aluminum jeep bows. The basket is lined with canvas. When the chopper arrives, the CP personnel jump aboard, the chopper hovers over the CP basket, hooks up and takes off. The senior officer merely indicates the destination to the pilot on a marked map. Upon arriving at the position, the basket is released on touching the ground by a quick release device; the chopper lands; the men jump out; and the chopper is on its way for another priority mission.

The CP may again be displaced by the same method or a land link-up may be used.

This system enables us to move

and to cover long distances quickly. Even though the roads themselves may be in good shape, traffic usually delays a major displacement by road. The air displacement enables us to occupy the most advantageous ground from a communications point of view since many of the best hills are well nigh inaccessible during the winter months.

So much for what we have done. What do we need to do the job better? Being on the ground and knowing what the Soviets are apt to bring against us, it is not difficult to determine what we should have in the foreseeable future. Let's take the requirements in the order move, shoot and communicate.

Move

We should have a lighter carriage than we now have. We believe 27 tons wrapped around a light howitzer is just too much. The carriage is too big and awkward and eats too much gas. We need a more compact, lighter and more agile carrier.

Shoot

The light howitzer should have a range of at least 20,000 yards and the turret should be so designed as to give us 360° of traverse once the gun is laid. In future war we must expect the action to take place in any quadrant and we will not have time to move each battery in order to handle targets to the flanks or rear. Initially we did not install our sights until we reached the firing position. We found that it required from two to 14 minutes to place the sights in firing position. In addition, we found that by trying to install them quickly, they were very often damaged. Now once we are in the combat area we install our sights and leave them installed. The local ordnance has devised a steel cage to protect the sight from overhanging branches or other obstacles. The cage may be readily moved when the howitzer reaches a firing position.

Communicate

As I have indicated, we are now getting the most out of our presently authorized radios; however, there is a great disadvantage in operating with line of sight radios. Perhaps nothing can be done about this for some time or perhaps until mental telepathy is perfected. However, there are certain things that can be done in view of the present state of the art. In the first place, our radios should have greater ranges. They are not adequate for the range over which we must operate. Recently we were issued artillery band radios in place of radios on the armor band. The frequencies of the artillery sets allow us to achieve better communications; however, at the same time, operating on these frequencies creates problems. We are not as capable as we were in communicating with the armor or the infantry, though we have sets for this specific purpose. The number of sets on the armor or infantry frequencies is limited; hence, when a set goes out it is no longer a matter of just getting another set. We must replace it with a set built to a specific frequency range. The combat arms should be equipped with radios that recognize no branch or service, but which provide communication channels for all units on the same team. At the same time, we must have voice radios which require no encoding or decoding. Future combat just will not allow for this waste of time. We must secure scramblers for our radios and we must get them quickly.

Since I have used the word "quickly," I am forced to think of the composite battalion which I have not mentioned before. It is in the composite battalion where the word "quickly" has a different connotation than anywhere else in the artillery. I am referring specifically to the composite battalion's atomic capability. The howitzer batteries in the composite battalion and the composite battalion (-) took the same test as the light batteries and battalions, allowing, of course, a little more time for getting into position. This was perhaps a mistake on our part for the 155s and the 8″ pride themselves as being every bit as fast as the 105s. This pride is backed up by facts and figures and is by no means an idle boast.

After having worked with the composite battalion for a year and a half, I believe that it should be reorganized. We should have three batteries of 155s, enabling us to place one battery with each light battalion if necessary. The 8″ battery should be in

(U. S. Army)

All CP equipment is loaded in the 6′x6′x2′ metal basket, canvas lined, shown at left.

(U. S. Army)

When helicopter arrives CP personnel hop aboard, basket is hooked up and it takes off.

(U. S. Army)

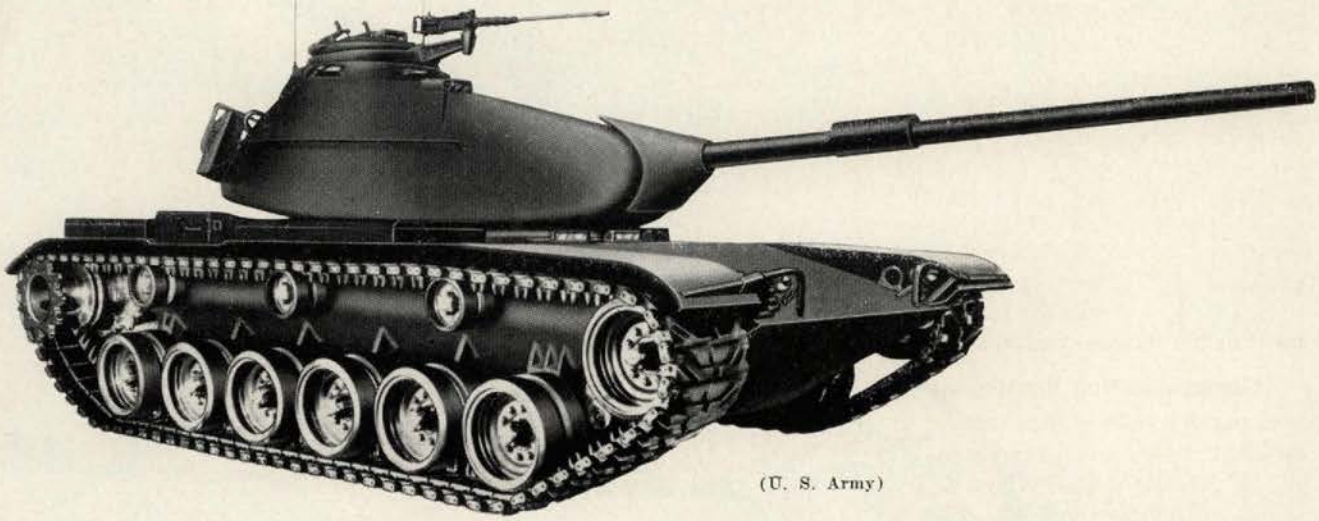
The Honest John should be in a separate battalion. Two launchers for a division are not sufficient. The division should have a battalion of three batteries of two launchers each and should have enough personnel to provide security.

Corps Artillery since it is too heavy and cumbersome to maneuver with an armored task force. I know the personnel of my 8″ battery will resent this and justifiably so, since they have never received anything less than superior in any test or inspection, but they are just good people and would have done well had they been equipped with ballistas.

The Honest John should be in a separate battalion. Two launchers for a division are not sufficient. The division should have a battalion of three batteries of two launchers each and should be provided sufficient personnel to provide the necessary security. As things stand now, the Honest John battery, the most critical unit in the armored division, is the smallest combat unit in the division. Higher headquarters require a certain degree of protection for this battery and its equipment but no personnel are provided. The job always ends up as the responsibility of the composite battalion commander who at best can only rob his gun batteries for personnel to guard the Honest John Battery and its ammunition.

The Army is making a very serious mistake in keeping such an organization understrength. In future war, this type unit will be one of our most important. How better can we provide men trained in atomic weapons than to put them in such an organization during peace time. In addition to its normal operating responsibilities, the Honest John units have by far the most difficult supply problems in the division. Under the current TO and E, they cannot do the job effectively. We all now appreciate the fallacy of the "bigger bang for the buck," but in our own family, it appears foolhardy to provide insufficient personnel for the one unit in the division that outweighs the remainder of the division 100 to one in firepower. The Honest John has proven itself somewhat more accurate than the firing tables indicate; yet it is not sufficiently accurate to provide the division's main atomic punch. The sooner we can replace it with the Lacrosse, the sooner will we be able to deliver atomic firepower where and when we need it. The "when we want it" is just as important as the where. Present procedures of preparing the weapon for firing and for computing data are entirely too slow. They would have been acceptable for a World War I operation but they will not be adequate for the next war. We must have an atomic weapon that requires no more preparation than an artillery shell and we must be able to compute data electronically or mechanically. The paper and pencil method is no longer accepted in the grocery store. A stride forward in this area is mandatory.

To go back a bit to that matter of quintessence to which I referred, perhaps agility encompasses such matters as pugnaciousness; but whether it does or not, I wish to close on this note. In addition to being agile, the artilleryman of the next war must have a pugnacious attitude. He will be constantly surrounded and cut off by the enemy and yet must get his job done. He will not be expected to win the war by himself, but the infantry and armor will be too busy to worry about his security. He must protect himself against all comers be the enemy armor or infantry. He has the means to do the job and must expect to do it habitually. He must have the attitude that it is just too bad for the other fellow, in front, behind, to the right or the left; for when the armored artillery moves in, the issue is all one-sided from that point on.



(U. S. Army)

The M60 Medium Tank

RECENTLY, through various news media, it has come to light that the Army will place orders for a new medium tank. From unclassified sources we were able to piece together the following information concerning the M60, which has been planned in the 1959 and 60 fiscal budgets.

The new main battle tank, the M60, which has been selected to replace the Patton M48A2, will incorporate a significant improvement in the weapons system and operational range of the vehicle and improve crew protection.

Three Significant Improvements

The research and development phase of this tank, now completed, was conducted by a development program of tank major components. This component program has produced significant improvement over our present M48A2 in three major areas. These are:

1. A 105mm gun-ammunition system capable of defeating all modern tanks of any potential enemy.
2. A diesel engine which will greatly increase the tank's operational range.
3. Improved crew protection.

It is anticipated that the M60 tank will contain some 50 major and minor improved components over the standard M48A2 tank.

At the present time availability of these vehicles for operational use will be in either April or May of 1960.

Components Can be Installed in the M48A2

An outstanding feature of the power plant and new weapon system is that it can be installed into the present M48A2 Patton tanks. This will greatly increase the cruising range of our present medium gun tanks which are operational and give them an added firepower punch. By installing these new components in our present vehicle the Army's modernization program of Armor will be completed at an earlier date. Initially the new M60s will utilize the M48 turret until the new and improved turrets are off the design boards and available for mass production.

Some of the details of the new M60 tanks are discussed below by component.

The Turret

The new optimum turret design will contain better ballistic protection than that provided by the M48A2 turret. It will also provide a decrease in overall volume, silhouette and weight and should incorporate a simple fire control system over that now used in the M48A2 turret. The platform, identical to the M48A2, is of aluminum construction. Provisions have been added for stowage of 55 rounds or more of 105mm ammunition, and ready-round boxes for caliber .50 ammunition and other necessary storage. The 105mm racks will be of tubular aluminum construction. The caliber .30 or 7.62mm ammunition is stowed similar to the box in the M48A2. The latter type of ammunition will be used in the new coaxial tank machine gun.

The Main Armament

The M68 cannon, electrically actuated, is comprised of the T254E2 breech assembly and the 105mm tube with bore evacuater. The M116 gun mount is used in mounting the M68 cannon. The mount will have provisions to mount the caliber .30 or 7.62mm coaxial machine gun and the articulating telescope assembly. An improved cupola capable of providing overhead protection for the tank com-

mander against blast, sniper fire and shell fragments and eliminating many of the inherent deficiencies of the M1 cupola of the M48A2 tank, will be installed. This cupola should accommodate both the standard caliber .50 machine gun M2 as well as the newer and shorter version which will replace the M2 in the near future. (Unfortunately the picture, on page 12, does not contain the improved tank commander's cupola to be used with this tank.)

The gun controls will enable the main armament to have a maximum elevation of 20 degrees and a depression of 9 degrees with the main armament in the forward position.

THE M60 MEDIUM TANK

Combat Loaded Weight	**102,000 lbs.***
Ground Pressure	**11.15 lb/sq. in.**
Crew	**4**
Engine	**AVDS-1790-2**
Transmission	**CD-850-6**
Cannon	**105mm**
Breech Type	**T254E2**
Secondary Armament	
One—caliber .30 or 7.62mm machine gun	**M37 or T197E2**
One—caliber .50 machine gun	**M2 (T175 later)**
Two—caliber .45 sub-machine guns	
Mount-Gun Combination	**M116**
Usable Fuel	**350 gal.**

*** Less Kits, with 1950 lbs of additional fuel.**

Communication Equipment

Communication systems that can be installed in the M60 turret are either:

1. AN/GRC 3, 4, 5, 6, 7, or 8 and AN/VIA 4; or
2. AN/GRC 3, 4, 5, 6, 7, or 8 and AN/VIA 4 and AN/VRC 24

Provision will be made at a later date for incorporating newer and improved radios as they become available.

Power Plant

The M60 vehicle receives its power from the compression ignition (diesel) engine AVDS 1790-2. This 12-cylinder, 90 degree V, air cooled, supercharged compression ignition engine has a displacement of 1790 cubic inches. The engine and transmission oil coolers are mounted at the upper portion of the engine along the sides, using engine cooler fans to provide air flow. It develops greater torque at lower speeds than the standard AVI 1790-8 spark ignition (gasoline) engine. Claims have been made that engine noise silence is accomplished by the turboblowers and thus eliminates the requirement for mufflers.

Advantages obtained by using this diesel engine are:

1. Provides better fuel economy.
2. Eliminates the need for an auxiliary engine.
3. Utilizes the modified CD 850 transmission.
4. Eliminates the use of mufflers.

Preliminary tests revealed that fuel compression was considerably less in the diesel engine than the present gasoline engine. This naturally increases the cruising range capability over the gas-hogging M48A2 and should decrease our Class III logistics headache now present in armored units.

It also should be noted that the fuel consumption of the diesel engine at idle is *less* than the fuel consumption of our present auxiliary engine at full load. Therefore the need for the present "Little Joes" in the new tank as a source of electrical power is eliminated. This saving in space can now be used for additional fuel storage.

By acquiring this additional space the fuel tank capacity is 350 gallons of usable fuel. The two fuel tanks are interconnected thus allowing flow between the tanks. This also permits a single filling position for both tanks which can be filled at the rate of 50 gallons per minute. An emergency filling position is also provided. The tanks are so arranged that flow of fuel can be in either direction which prevents immobilization in case one tank becomes fractured.

Electrical System

The electrical system contains dual instrumentation on the engine and transmission in conjunction with the all-gauge panel. The electrical system includes connections for kit installation such as winterization aids, a deep fording kit and a searchlight. The instrument panel, located so that it will be readily visible to the driver, provides gauges for engine and transmission oil pressure and temperature, voltmeter and fuel level.

Suspension System

The suspension system, although similar to the current M48A2, has some refinements. The tension idler has been removed as a result of tests on our present medium tank which established that, despite removal, there is no greater tendency to throw the track. This has resulted in the saving of weight, cost and a reduction in parts. Over-all vehicle weight saving have been achieved by welding the track support brackets, front-to-rear roadwheel housing bump stop brackets and intermediate positive stop brackets to the hull. Other weight saving has been accomplished by using aluminum in parts such as roadwheels of the suspension system.

Summary

The *Progress Report for 1958*, recently released by the Department of the Army, contains a reference to our present M48A2 Medium Tank. It is stated that we need the following:

1. Reduced weight and lower silhouette.
2. Improved operating range.
3. Lower fuel consumption.
4. Quieter operation.
5. Increased automatic firepower.
6. Improved crew visibility.
7. Ability to fight under all conditions of visibility.
8. Improved radiological protection.

It would appear, at first glance, that the improved M60 takes many steps forward to give us these desired requirements. Until this vehicle becomes operational and thorough field testing is accomplished it can only be concluded that—time will tell. However, we have faith in our experienced planners, researchers and developers and feel that it is a big step forward.

Submitted herewith to the membership is the annual report covering the general affairs of the Association for the calendar year 1958

The Annual Report of the Secretary-Treasurer-Editor

The Association

The aims and purposes of the Association were continued during the year 1958. These aims and purposes, as set down in ARTICLE III, sub-paragraph 1, of the Constitution, are "to disseminate knowledge of the military art and sciences with special attention to mobility in ground warfare; to promote the professional improvement of its members; and to preserve and foster the spirit, the traditions and the solidarity of Armor in the Army of the United States."

The 69th Annual Meeting was held at Fort Knox during the period 1-2 May 1958. The off-post attendance far exceeded the record high set in 1956, which confirms our beliefs in the professional interest in the mobile arm. This keen interest was generated by members of all components, retired personnel and many industrial leaders who have either a development or manufacturing interest in our user products. We were privileged to have the Army Chief of Staff, General Maxwell D. Taylor, as our principal speaker. In addition to our Chief of Staff, we were fortunate in having the Chairman of the Joint Chiefs of Staff, General Nathan F. Twining, USAF, present for the second day's activities. Lieutenant General George W. Read, Jr., Commanding General, Second U. S. Army, was elected to the Presidency of the Association, succeeding General Willard G. Wyman, Commanding General, USCONARC, who has since retired.

One resolution was proposed from the floor during the business session. This resolution gave the outgoing President, General Wyman, a standing ovation for his untiring efforts in the leadership of this Association during his year's tenure of office.

Two Executive Council meetings were held during the year. The first meeting was held at Fort Knox immediately following the business session of the Annual Meeting on the afternoon of the first of May. At this meeting,

FINANCIAL REPORT OF THE UNITED STATES ARMOR ASSOCIATION

For the Year Ending 31 December 1957
CASH RECEIPTS & EXPENDITURES

Department	*Receipts*	*Expenditures*
ARMOR Magazine	$34,517.80	$25,928.42
NEWSLETTER		2,241.96
Book Department	3,554.98	2,419.94
Income from Investments	457.20	
District of Columbia Sales Tax	2.06	2.33
D. C. Personal Property Tax		41.86
Postage		1,848.52
Office Supplies	1.75	287.84
Stationery & Printing		1,171.83
Telephone & Telegraph	.20	403.35
Machinery & Equipment		428.94
Maintenance & Repair of Equip.		79.00
Rent		2,640.00
Travel Allowance		1,080.00
Travel Expense		22.70
Express Charges	8.95	55.48
Executive Council & Editorial Exp.		196.33
Fire Insurance		27.28
Awards & Contributions		230.00
Royalty on Book	18.91	
Miscellaneous		8.27
SUB-TOTALS	$38,561.85	$39,114.05
Cash Balance (1 Jan. 1957)	3,923.07	
Inactive Outstanding Checks Cancelled	22.41	
Cash Balance (31 Dec. 1957)		3,393.28
GRAND TOTAL—CASH RECEIPTS & EXPENDITURES	$42,507.33	$42,507.33
NET WORTH—December 31, 1957		$22,256.49

For the Year Ending 31 December 1958
CASH RECEIPTS & EXPENDITURES

Department	*Receipts*	*Expenditures*
ARMOR Magazine	$34,130.93	$22,141.96
NEWSLETTER		2,218.21
Book Department	4,311.83	4,463.16
Income from Investments	497.80	
District of Columbia Sales Tax	1.58	1.27
D. C. Personal Property Tax		40.69
Postage		1,157.18
Office Supplies		160.06
Stationery & Printing		1,194.25
Telephone & Telegraph	1.68	427.29
Maintenance & Repair of Equip.		99.00
Rent		2,640.00
Travel Allowance		1,080.00
Travel Expense		14.95
Express Charge		32.41
Executive Council & Editorial Exp.		246.76
Fire Insurance		5.38
Awards & Contributions		286.38
Royalty on Book	4.41	
Association Annual Meeting Exp.	3.31	790.00
Miscellaneous		5.50
SUB-TOTALS	$38,951.54	$37,004.45
Cash Balance (1 Jan. 1598)	3,393.28	
Cash Balance (31 Dec. 1958)		5,340.37
GRAND TOTAL—CASH RECEIPTS & EXPENDITURES	$42,344.82	$42,344.82
NET WORTH—December 31, 1958		$23,660.00

as required by the Constitution, your Secretary-Treasurer-Editor was reappointed. Also Brigadier General Hal C. Pattison and the Secretary were appointed by the President to represent the Association at the services in Washington honoring the Unknowns of World War II and Korea. A floral tribute was presented in the Capitol Rotunda and your representatives attended the afternoon interment services.

The second meeting was held in Washington, D. C. on the 3d of December. Plans were made for the 70th Annual Meeting at that time. *Fort Knox was again selected as the site and the tentative dates are 7-8 May, 1959.* Other posts had been considered and preliminary investigation had been made of Fort Hood, Texas, Fort Polk, Louisiana, Fort Bragg, North Carolina and Fort Meade, Maryland. These sites were eliminated for various reasons such as lack of facilities and possible troop commitments at the time of the meeting. The Commanding General of the U. S. Army Armor Center, Fort Knox was appointed as the Chairman of the program committee. Other members included the Commanding General of the U. S. Army Training Center, Armor; Major General Harry W. Johnson, USCONARC; and Major General Robert W. Porter, Jr., DCS/PERS, D/A. The first two members were named in position only in view of an impending command change. (See News Notes, page 53 in this issue.) A nominating committee was appointed, chairmaned by Lieutenant General Willis D. Crittenberger, Ret. Other members are: Major General Donald W. McGowan, National Guard representative; Colonel Willard Webb, Army Reserve representative; and Brigadier General Hal C. Pattison and Colonel Lawrence V. Greene, Active Duty representatives. The auditing committee was appointed and instructed to audit the books for the calendar year 1958 and review this annual report which you are now reading. (This was accomplished on 5 February 1959.) Chairmaned by Brigadier General Willard A. Holbrook, Ret., other members of the committee are: Brigadier General Charles G. Dodge; Colonel F. W. Boye, Jr.; and Colonel Samuel McC. Goodwin.

We reported last year that receipts for 1957 were greater than at any time since World War II. It gives us great satisfaction to report that this amount has been exceeded this year by approximately $400.00 giving the Association a grand total of more than $38,950.00. Expenditures were considerably less this year. We desired to have more funds on hand at the end of the year in view of the fact that a much-needed Addressograph machine has been ordered for the Circulation Department.

The financial report, shown on these pages, reflects the past two years' receipts and expenditures. You will also note that magazine receipts are slightly behind last year; however, due to a slight increase in the number of two-year memberships, our total membership and unit subscriptions remain approximately the same. Although book receipts for this calendar year are less than expenditures, we had outstanding a book account receivable (since paid) which would have offset this differential.

The Magazine

Two issues during the year contained 72 pages and four issues contained 64 pages. Although this year's total pages

do not come up to the previous year, we have endeavored to pick up extra pages by limiting our book advertisements to inside covers and the last page of the magazine. Owing to increases in postage, we also felt we should hold the number of pages down until we could see the effects of this added expense. We intend to increase the number of pages again, depending upon our issue to issue income which we have on hand. In the January-February issue, we published the first of a three-part series entitled "The Structure and Functions of Armored Divisions" by Richard M. Ogorkiewicz. This three-part feature was reprinted by many foreign journals as well as in the States for school use. The March-April issue highlighted the 70th Anniversary of the magazine. The July-August issue contained the report of the 69th Annual Meeting. Many other articles have been reproduced by other military magazines which leads us to believe that our material is the type needed by our membership in search for additional professional military knowledge.

The Newsletter

This was the second consecutive year for our Newsletter which was started in January 1957. Due to postage increases the cost of the Newsletter has increased slightly. However, we feel that the monthly contact with our members and U. S. (to include APOs) subscribers makes this Newsletter a worthwhile contribution to the Association's aims and purposes. We glean news items from Department of Defense press releases, unit newspapers, Armored School and Armored Center items and other periodicals. We welcome the submitting of material for use in the Newsletter, as well as magazine articles, from all our members and units, to include civilian industry.

The Book Department

Book Department receipts were higher this year than any year since 1953. During the year we reprinted in booklet form a series of six articles which had appeared in *ARMOR* during 1953-54. These articles are entitled: *Notes on the Training of an Armored Division* by Major General Hamilton H. Howze. Thousands of copies were sold to Reserve component and Active Army Armor units. Thus this book was the year's best seller. Other best sellers were: *Tank Commander's Guide; Soviet Strategy in the Nuclear Age* by Garthoff; *Lost Victories* by von Manstein; *Drive* by Codman; *War—1974* by Rigg; *War and Peace in the Space Age* by Gavin; and *Panzer Battles* by von Mellenthin. In addition to the books advertised in the magazine, we have continued to insert book brochures in our expiration notices. This has proved to be the best method of advertising important books and has brought us our greatest return. We will continue to award books as prizes for OCS, USMA and ROTC graduates. On all book orders *over* $5.00 the purchaser should take a ten percent discount. We also pay the postage when your check accompanies your order.

There is still a stock of binders on hand which are available for sale. Each binder holds a two-year supply of magazines.

The Association will endeavor to obtain any book in print that is ordered by members and unit subscribers whether or not they are advertised in the magazine.

Summary

The year 1958 has been an outstanding one for the Association. We are on a firm financial basis and expect to continue in this upward direction.

The material, voluntarily contributed by our members, has done a great deal to enhance the military professional value of the magazine. In addition to supporting our aims and purposes, we have endeavored to support the United States Army and the Association of the United States Army editorially in the magazine and Newsletter.

The permanency of the published material can be confirmed by the number of reprints requested and the ARMOR binders sold each year.

We would like to take this opportunity to ask each and every one of you to keep us informed of any change of address. We also would like to ask unit commanders to keep us informed of any change of unit designation due to conversions. This will particularly apply to Reserve component units which will make many changes this coming year. During the past year, many Adjutants of Gyroscoping units sent us complete lists of members and units being moved. This is the support we need in order to keep you abreast at a minimum cost to the Association.

This is your Association and the products belong to each and every one of you. We are merely the clearing house which endeavors to bring to you the best in our military profession.

We welcome your suggestions in the betterment of our Association.

THE 70TH ANNUAL MEETING OF THE UNITED STATES ARMOR ASSOCIATION

The 70th Annual Meeting of the Association will be held at The U. S. Army Armor Center, Fort Knox, Kentucky. The dates for the meeting are 7-8 May 1959. The Program and Nominating committees, as appointed by the Association President and reported elsewhere in these pages, are presently engaged in the preparation for presenting the biggest and best meeting held to date. Please reserve these dates and try to be with us. Members will receive official notices by first class mail in early March.

(U. S. Army)

Chariots

The First Combat Vehicles

By RICHARD M. OGORKIEWICZ

IN search of parallel and example, or merely for the sake of picturesque background, it is common to turn to the pages of history and compare the tank with various early methods and devices. The list of such similes has become quite extensive, ranging as it does from medieval battle wagons and mail-clad horsemen to ancient battering rams, elephants and war chariots.

Of these and many other methods and devices, recalled with varying degrees of aptness and described in terms ranging from archeological fact to fanciful tale, one certainly deserves serious attention—the chariot. It does so for being the first combat vehicle ever used and because its introduction, many centuries ago, represented the first advance on the primitive and still predominant method of fighting on foot.

Chariot troops, or chariotry, were, in fact, the first mobile troops to appear in warfare and they are the lineal ancestor of the mobile armored forces of today—the grandparent so to speak, the in-between generation being represented by cavalry. Moreover, chariots are of topical, as well

RICHARD M. OGORKIEWICZ, a frequent contributor to *ARMOR*, is a consulting engineer and lecturer at the Imperial College of Science, London University. He graduated from that institution in 1946. Prior to his present assignment he held positions with the Ford Motor Corporation and Humber Ltd., London, England.

Chariots were the first combat vehicles ever used. They deserve attention because they represent the first advance on the primitive and predominant method of fighting on foot.

as historical, interest for some of the concepts which governed their use more than 3,000 years ago are relevant to the latest trends in tank development.

The First Vehicles

The chariot first gained prominence as an implement of war in the Middle East at the beginning of the second millenium B.C. However, even then, it already had a considerable background of earlier developments. Wheeled vehicles, drawn by oxen, were used soon after 3500 B.C. by the Sumerians, the ancient inhabitants of lower Mesopotamia—the fertile delta of Tigris-Euphrates in what is now Iraq. And by about 3000 B.C. four and two wheeled vehicles drawn by onagers, or wild asses, were being used in war.

Of the two vehicle types, the two-wheeled chariot gradually ousted the less maneuverable four-wheelers and in the latter part of the third millenium the Sumerian onager-chariot is thought to have attained a position of considerable importance. It was, however, still a cumbersome vehicle, with relatively small heavy solid disk wheels, and slow even when drawn by four onagers. Its effectiveness was probably greater as a transport vehicle, in bringing warriors quickly to battle, rather than as a vehicle from which to fight in battle.

Soon after 2000 B.C., however, two events occurred which revolutionized the use of chariots and warfare itself. The solid disk wheel, usually made of three wooden planks suitably carved was replaced by the much lighter spoked wheel and horses were introduced as draught animals, probably from the Iranian plateau.

The simultaneous appearance of the chariot horse and of the spoked wheel greatly increased the mobility of chariots and this, in turn, revolutionized the pace of warfare. Their appearance coincided also with a wave of tribal migration which swept across southwest Asia and in the hands of the Indo-European Kassites, who conquered Mesopotamia, the Hittites, who established themselves in Asia Minor, and the Semitic Hyksos, who conquered Egypt, chariotry became the decisive mobile arm.

The Hyksos invasion of Egypt around 1680 B.C. is the best known exploit in the early use of chariots. So effective were they, in combination with missile weapons, or bows, that the Egyptians spoke of their land as having been conquered "without a battle"—which to them, hitherto, meant a pitched fight at close quarters. Then, after a century or so of domination, during which the Egyptians begun to copy the methods of the invaders, the Hyksos were driven out and the Egyptians, in turn, used chariots to carry their arms into Syria and to the Euphrates.

(U. S. Army)

Egyptian chariots and infantry.

Egyptian Chariots

Horse drawn chariots came into large scale use in Egypt at the beginning of the 18th dynasty, which ruled between 1587 and 1375 B.C. and which completed the expulsion of the Hyksos. During this period the Egyptians mastered the art of chariot making and their army, composed of a large proportion of chariotry, became the dominant element within the state and of its importance to the world at large. With this army and its swift chariots, led by fighting pharaohs such as Thutmoses III, the victor of Megiddo of 1479 B.C., Egypt reached the height of its power.

The Egyptian chariots were very light two-wheeled vehicles each drawn by two horses. They were light enough to be lifted by one man and their lightweight construction can be studied in detail from the marvellously preserved specimen found in Egyptian tombs. Probably the best known is that from a 15th century tomb at Thebes which is now at the Museo Archeologico in Florence, Italy; others, notably from the tomb of Tutankhamun, are at the Cairo Museum, Egypt.

The framework of an Egyptian chariot was of light wood, heat-bent where necessary, the body being filled in with canvas or leather. In the case of the chariots of Tutankhamun, for instance, the floor was made of interlaced leather strips. The light leather-tired wheels had four or six spokes and were set well back; they were of relatively large diameter and with a wide track—the former giving low rolling resistance and the latter stability when maneuvered at speed.

The normal crew of an Egyptian chariot consisted of two men: a driver and a weapon bearer. The principal weapon of the latter was the bow, and the chariot was essentially a highly mobile platform from which to shoot arrows. Its effectiveness, in other words, was based on a combination of mobility with missile power. It had no armor but relied entirely on its offensive characteristics.

Missile Tactics

The battle tactics of the Egyptian chariotry were in keeping with their vehicles and weapons. They would charge shooting arrows and if the enemy stood firm and could not be ridden down wheel round for another missile attack. Or they would

sweep round the hostile force showering it with missiles—one of the advantages of the chariot being that it could carry a good supply of arrows.

Such, in essence, were the tactics at the battle of Kadesh, on the Orontes in Syria, in 1288 B.C., or 1296 B.C. according to some recent estimates of the Hittitologists. This was the first battle in history of which detailed record has survived. The battle was brought about by Egyptian attempts to maintain their position in Syria against the Hittites who in the latter part of the second millenium established themselves as the leading power in southwest Asia and were pushing southward from their Anatolian base.

The power of the Hittites was based on their chariotry which resembled the Egyptian but used somewhat heavier vehicles carrying three men, the third man being a shield bearer. At the approaches to Kadesh a large force of such chariotry surprised an Egyptian expeditionary force led by Pharaoh Ramses II, advancing north in a strung-out line of four divisions. The Hittite chariotry attacked from the right of the Egyptian line, cut to pieces the second division and then turned on the first or leading division. Only the personal valor of the Pharaoh, who led repeated charges of his bodyguard chariotry, and disorganization among the Hittites, who stopped to plunder an Egyptian camp, saved the Egyptian army from destruction. As it was, both sides suffered heavy losses and the shattered Egyptian forces drew off to the south.

The strength of each of the opposing armies, in what was one of the biggest battles of Antiquity, has been estimated at about 20,000 men. What proportion of the Egyptian army was made up of chariotry is not clear but it is known that a division of the Egyptian field army of the period consisted of both chariotry and infantry and that the chariotry was organized into squadrons of 25 chariots. On the Hittite side the forces engaged consisted entirely of chariotry and the Egyptian account of the battle speaks of a main body of 2,500 Hittite chariots and a reserve force of 1,000. Two centuries earlier Thutmoses III recorded the capture of 924 chariots after the fall of Megiddo, a figure which is a further illustration of the numbers used and an indirect reminder of the massed employment of chariots which contributed to their importance and success in battle.

Kadesh was the last major battle between the Hittites and the Egyptians. It was, in fact, the high water mark of the offensive power of both empires which thereafter passed on to the defensive and begun to decline. Within a century of the battle of Kadesh the Hittite empire perished in another wave of tribal migration. The Egyptian, more fortunate in its geographical location, lasted several centuries longer but eventually, having lost its earlier spirit and military proficiency, it too succumbed —to Assyria.

Assyrian Chariotry

The Assyrians, who took the place of the Hittites as the leading nation of southwest Asia, begun with an army similar to that of the earlier states, that is composed of chariotry and infantry. The Assyrian chariots, however, were heavier than the Egyptian and they grew larger and heavier still; they carried three or even four men, those additional to the driver and the bowman bearing shields. The greater carrying capacity and the heavier build inevitably made them less mobile and the terrain over which Assyrian armies operated was also more difficult at times. For instance, the records of Tiglath-Pileser I, the first Assyrian conqueror king of about 1115 to 1102 B.C., several times speak of difficult country where "chariots could not pass." Moreover, the Assyrians frequently were faced not with battles in the field but with siege operations, at which they came to excel and for which they gained a reputation equal almost to that for their cruelty. All these factors—the heavier vehicles, the terrain and the frequent sieges—must have had an adverse effect on Assyrian chariotry but it continued to occupy an important position, as an elite corps, right up to the end of the Assyrian empire at the close of the seventh century B.C.

The importance of chariots during the period of Assyrian domination is reflected in the Hebrew scriptures and in particular in the often-quoted passage from the Book of Judges, Chapter I, verse 19:

> And the Lord was with Judah and He drove out the inhabitants of the mountains, but He could not drive out the inhabitants of the valley because they had chariots of iron.

This shows clearly the importance attached to chariots by the Hebrew scripture-writers. It also indicates the technological revolution which took place during the period of Assyrian domination when iron begun to replace bronze as the principal working metal. As a result, bronze chariot parts were superseded by others made in iron but there is no reason to believe, as some modern writers have done, that the chariots referred to in the Book of Judges went beyond this and departed from the established wooden construction, or that they were actually armored with iron.

The Dawn of Cavalry

A further factor which affected the position of chariots in the Assyrian army was the appearance of a new mobile arm—the cavalry. It supplemented and eventually, in the armies of another power, took the place of chariotry. This power was Persia, which succeeded Assyria after an interlude of Neo-Babylonian or Chaldean domination and whose armies dispensed almost entirely with chariots.

The art of fighting on horseback was evolved only around 1000 B.C. In Assyria mounted troops first appear during the reign of Ashur-nasirpal II, which lasted from 883 to 859 B.C., and were probably the result of contacts with the horse riding peoples of the Central Asian steppes. A century later, under Sargon II (722 to 705 B.C.) when Assyria reached the height of its power, cavalry was a well established element of the army and being more adaptable was used by Sargon as the mobile arm in circumstances where chariots could not operate.

Assyrian cavalry, which was the first regular cavalry in the world, consisted of two types: archers and lancers. Of the two, the former appear to be the earlier but as they frequently shot dismounted they are, perhaps, to be regarded more as mounted infantry rather than cavalry. The lancers, however, were true cavalry fighting on horseback. Their principal weapon was a light lance

and they wore pointed conical helmets and armor of small metal plates sewn on to linen or leather. In a way they were the forerunners of the heavy cavalry of the following 2,000 years and especially of the Parthian and Sassanid *cataphracts* and the mailed knights of medieval Europe.

The Persians, who took the place of the Assyrians as the masters of western Asia, exploited further the advantages of cavalry. Indeed, at first Persian armies consisted largely of cavalry and they owed much of their success to the consequent ease and rapidity of their movement. With the appearance of the Persians the chariotry, which hitherto had been the dominant mobile arm but which was less adaptable and flexible than cavalry, was inexorably displaced. What little chariotry was retained by the Persians degenerated into a kind of ponderous super-heavy cavalry—a development which may well have begun with the Assyrians. It was employed sporadically and not too successfully, in spite of the formidable appearance of their chariots which were now fitted with scythe blades at the wheels or at the end of the draught pole.

Scythed Chariots

Xenophon, the Athenian general and historian of the early fourth century B.C., credits Cyrus the Great, the founder of the Persian empire, with the successful use of 300 scythe-bearing, or *drephanephoros,* chariots at the battle of Thymbra in 546 B.C. However, the details of this decisive battle between the Persians and the Lydians of Asia Minor presented in Xenophon's *Cyropaedia* are open to doubt. What is far more important in Xenophon's writings is his eye witness account of the use of scythed chariots at the battle of Cunaxa in 401 B.C. This battle ended the attempt by Cyrus the Younger to wrest the Persian throne from his brother Artaxerxes and was the starting point of the famous retreat to the Black Sea of Cyrus' Greek mercenaries, the 10,000, which Xenophon led and subsequently described in the *Anabasis.* As for the scythed chariots, of which 150 were used by Artaxerxes, they proved ineffective against the Greeks who opened their ranks and let such of the unhandy vehicles as reached them pass through while others, out of control, did more damage to their own troops.

Scythed chariots were used again at the battle of Gaugamela, or Arbela, in 331 B.C., where Alexander the Great dealt the final blow to the Persian empire. The Persian army, a large motley collection which bore little resemblance to its predecessor of two centuries earlier, possessed 200 scythed chariots which were made to charge Alexander's troops over specially levelled ground. But, showered with arrows and javelins by Alexander's light infantry, they accomplished little except their own destruction.

Scythed chariots were used yet again at the battle of Magnesia, in Asia Minor in 190 B.C., where the Romans and their allies fought Antiochus IV, ruler of the Seleucid kingdom carved out by one of Alexander's generals from the Asiatic portion of the latter's empire. Antiochus' chariots were, however, quickly disposed of in a preliminary encounter by the slingers of the opposing forces. Antiochus also used elephants, with disastrous results for his own infantry, and Magnesia proved to be their last really serious appearance in European warfare. The first was in Alexander's battle on the Hydaspes against the Indian king Porus in 326 B.C.

The last of the infrequent major engagements of scythed chariots was at the twin battles of Chaeroneia and Orchomenus in Greece in 86 B.C., where a Roman army defeated the forces of Mithridates IV, king of Pontus and Crimea. In neither battle were the Pontic scythed chariots successful and in the second they recoiled upon their own line, throwing it into confusion and presenting the Romans with an opportunity for a decisive cavalry charge.

After the battle of Orchomenus the Asiatic scythed chariots finally disappeared from the armament of the major powers. But on the fringes of the civilized world other chariots continued to be used, notably among the Celtic tribes of western Europe.

Celtic Chariots

The Celts were among the last to adopt the horse-drawn war chariot which was evolved in western Asia and which slowly spread from there to other parts of the world. At about the time the Egyptians adopted it from the Hyksos the chariot also began to appear in southeast Europe, probably as a result of contacts with the Hittites of Asia Minor. At any rate, by about 1500 B.C. chariots were used on the mainland of Greece and by 1000 B.C. they reached northern Italy and Sweden. The use of chariots also spread in the opposite direction, that is eastward. Thus, by about 1300 B.C., the middle of the Shang period, horse-drawn chariots were also being used in China.

Among the Celts of western Europe the use of chariots begun around 500 B.C. and it was subsequently extended by them to the British Isles. The Celtic adoption of chariots was probably the result of contacts with the Etruscans, who dominated the northern part of the Italian peninsula and whose chariots were modelled on those of Greece. In all three cases the chariots usually carried two men and were drawn by two horses, although three horse teams were used by the Etruscans and in some cases the Greeks even used four horse teams. However, by the time the Celts adopted chariots the Greeks themselves had already abandoned them as an implement of war. Their place was taken by horse riding but the Greeks produced virtually no cavalry of note and relied almost entirely on their infantry. It was the Macedonians of the fourth century B.C. who were the first in Europe to make really effective use of cavalry and Alexander the Great owed as much to his companion cavalry as to his Macedonian infantry phalanx. Cavalry was, in fact, Alexander's main striking force. A little earlier, in the fifth century B.C., cavalry also appeared for the first time in China, in the northern state of Chao (modern Shansi), as a result of contacts with the neighboring Turko-Mongol tribes.

Like the use of chariots, the method of fighting on horseback also spread westward across Europe and gradually displaced the former. For instance, when the Romans first gained prominence in the fifth century B.C. war chariots had already gone out of fashion in Italy. Thus, contrary to widespread belief, the Romans did not use chariots in war but only for ceremonial purposes and for racing. At the same time, however, the Romans —like the Greeks—remained well be-

hind western Asia in the use of the new mobile arm, the cavalry. What cavalry they had was usually furnished by their various allies.

Eventually even among the Celts horse riding displaced chariots. In the third century B.C. the Celts of France, or Gauls, were using chariots on a large scale and at the battle of Sentinum in 295 B.C. the initial onrush of the Gallic chariots almost overwhelmed the Romans. But they recovered and, significantly, carried the day with a cavalry charge. Two centuries later, at the time of Caesar's conquest of Gaul, the Gauls too had gone over to cavalry as the mobile arm.

But the Celts of Britain were still using chariots and Caesar met them in numbers during his two forays into southeast England, in 55 and 54 B.C., and described them in *De Bello Gallico.* Chariots were still used in Britain a hundred years later and the Romans met them again after their landing in A.D. 43, when they were conquering southern England. Romance and modern artists have endowed the chariots of the British Queen Boudicca, or Boadicea, who led the revolt of her tribe against Roman rule in East Anglia in A.D. 61, with scythe blades but there is no evidence to support this.

According to Tacitus, the Roman historian of the first century A.D., chariots were also used by the Caledonian tribes when Agricola, extending Roman rule over Britain, defeated them at the Grampian Hills in Scotland in A.D. 83. In this case Roman auxiliary cavalry had no difficulty in disposing of the Caledonian chariots and, in general, Tacitus in his *Agricola,* written soon after the latter's campaigns attaches little importance to British chariotry clearly placing British strength in infantry.

After the Roman conquest of Britain only a few war chariots remained in Europe. They lingered on among the lesser Celtic tribes, on the fringes of the Roman world, into the third century A.D.

Two Different Methods

The British use of chariots against Caesar was typical of their use in Europe in general. Except for occasional javelin throwing, particularly in a surprise swoop, fighting was seldom carried from chariots. For serious fighting the warrior dismounted and fought on foot while the chariot and its driver stood by ready to carry him away if things went wrong. This was the method practiced by Homeric heroes and most European chariot users after them. It was probably also the way the Sumerians used the original onager chariots in war and it differed radically from the methods evolved in the heyday of the chariots in the Middle East and particularly in Egypt.

To the Egyptians the chariot was a fighting vehicle in the full sense of the word—a vehicle from which they fought in battle. In Europe, on the other hand, the chariot was usually only a means of bringing the warrior to battle, or, in modern military parlance, a personnel carrier. The operational mobility which the chariot bestowed upon its European users was an asset and the harrying hit-and-run tactics of the British chariotry gave Caesar's troops considerable trouble during the campaign of 54 B.C. Nevertheless, the use of chariots in Europe represented a less advanced level of development than that reached earlier in the Middle East.

The explanation of this phenomenon must be sought in a combination of circumstances. The manufacturing resources were considerably smaller in Europe than in the older states of the Middle East and at first chariots were few in number and merely the conveyance of princes whose armies marched and fought on foot. On the whole the terrain was also less favorable, though this did not prevent the Gauls from eventually using chariots in large numbers. But the principal reason why European chariots were never as effective as the Egyptian, for instance, appears to lie in the failure to combine their use with that of missile armament. To use a current military expression, European chariots were integrated into a less advanced weapons system.

The Egyptian chariot owed its effectiveness to being, in essence, a highly mobile missile platform—a swift vehicle from which to shoot arrows. But Europe was slow to make full use of the bow and for a long time despised the use of archery in warfare. None other than Homer, in the *Iliad,* illustrates the preference for the sword and spear over the bow and the cult of the *arme blanche* was still strong a generation ago. For centuries, somehow, Europeans preferred to hack each other at close quarters and leave the more subtle ways of mobile fighting with bows to the "crafty" Asiatics. And as long as the methods of fighting at close quarters prevailed the European chariot could be little more than a transport vehicle.

The Past and the Future

The principles which made Egyptian chariots so effective 3,000 years ago are equally applicable to modern combat vehicles. Just as the chariot was most effectively used as a highly mobile vehicle from which to shoot arrows so the greatest value of armored combat vehicles lies in their ability to deliver mobile firepower. Similarly, the effectiveness of the future tank, like that of the Egyptian chariot, lies in the role of a highly mobile missile platform.

To fulfill this role there is an obvious need for more mobile armored vehicles and, even more, for a modern equivalent of the mobile missile tactics practiced by the Egyptian chariotry and brought to perfection in the age of cavalry by the Parthian mounted archers of Surenas in the first century B.C., the Seljuk horse archers of Alp Arslan in the 11th century A.D., the Turks of Saladin in the 12th century and the Mongols of Genghis Khan in the 13th.

As yet little has been done toward evolving a modern equivalent of such mobile tactics because, hitherto, armored forces have placed too much emphasis on armor protection and not nearly enough on their mobile weapon power. So far armored forces have been emulating, as it were, the ponderous medieval cavalry rather than the mobile horse archers. It is well to remember, however, that the heavy armor of the former did not save it from defeat and that European cavalry recovered its effectiveness in the 17th century when it discarded its heavy armor and concentrated once more on mobility.

Now, once again, the future of mobile forces lies not in heavy armor protection but in mobile equipment and in mobile tactics, which have proved so effective in the medium of another age.

Editorial

Many yearly reports come across this editor's desk from time to time. Some have a direct bearing upon the military profession while others are but indirectly related. One report that particularly appealed to this editor was the yearly report of the President of the Free Europe Committee, Inc. For more than two years, Lieutenant General Willis D. Crittenberger, Retired, has been the President of this important organization which has done so much to spread truth behind the Iron Curtain.

There are three main segments of this committee which are responsible for disseminating this information: Radio Free Europe, which is probably the best known; Free Europe Press; and Free Europe Exile Relations. There are other administrative groups, necessary in the day-to-day business of the Free Europe Committee, which are of equal importance. But it is the purpose here to inform our members of the work accomplished by those segments responsible for getting the facts to misinformed people from whom the truth is deliberately withheld by tyrannical leaders.

Radio Free Europe (RFE)

To this writer the most powerful sentence in the entire report is: "In the air, freedom is on the offensive; the Soviet is on the defensive." This naturally refers to the endeavors of Radio Free Europe broadcasts. How important they are can be confirmed by the studies based on interviews with three sample groups. Several hundred Polish, Czech and Slovak refugees were interviewed in two different surveys. The results revealed that some 97 percent had listened at one time or another to Western broadcasts, particularly those of Radio Free Europe.

Some of the most significant events of the year were thoroughly covered by RFE. These include: The death of Pope Pius XII and the election of Pope John XXIII; factual reporting of the Sputnik launchings and the Western World's efforts in scientific and military areas; and the facts on the Quemoy events, Mid-East developments and the Berlin crisis. Also the truth of the now famed "Dr. Zhivago" was brought to light by pointing out that it is the one book written by a Russian which, although honored by the world, cannot be read in Russia.

Favorable comment of RFE was reported in the *Pittsburgh Press* last June which concluded on the note: "Today Radio Free Europe sounds the voice of truth in the wilderness of a godless Communist tyranny. Its voice is one which proclaims freedom to all peoples. It is a voice of hope and an effective force of truth which exposes the diabolical lie of Communism to a segment of earth's oppressed humanity."

How effective this force is in the eyes of the Soviets was brought to light by the Soviet delegate at the United Nations, Mr. Sobolev, when he said on 2 December 1958, "The Soviet Union has effective countermeasures at its disposal to deal with any aggressive measures: the atom bomb in answer to the atom bomb; in answer to radio broadcasting, jamming stations." Is it not significant that he chose to class these two different subjects together as threats to Soviet power? We think so.

Free Europe Press (FEP)

The Free Europe Press conducts its operations through the *printed* word. During 1958 over one million copies of publications were produced and distributed behind the Iron Curtain and in the Free World. Designed to communicate factual information and Free World thought and opinion to readers in Eastern Europe; and likewise provide comprehensive and accurate information concerning current developments in Eastern Europe to the Free World, the FEP has sent material

all around the world. A high percentage of literature mailed behind the Iron Curtain has reached its destination. In fact, from letters received, these oppressed peoples are clamoring for more factual information—in short: the truth. To achieve this end, the FEP has solicited support of publishing houses, universities and foundations in making Western literature available on a gratis basis to East European readers. At the same time through interviews of refugees, comprehensive monitoring of radio stations and intelligent interpretation of their periodicals, FEP has become a rich repository of factual material on current East European affairs. This information has been disseminated throughout the Free World so that the truth can offset the Soviet propaganda they would have us believe.

To vouch for the usefulness of this information, many Free World countries have reproduced the material prepared by FEP on the Hungarian revolt and have made wide distribution of it in their own countries.

Free Europe Exile Relations (FEER)

The Free Europe Exile Relations group continues its efforts of advancing the cause of freedom for the countries of Central and Eastern Europe by assisting and cooperating with leaders and groups in exile due to Soviet oppression of their homelands. Owing to their first-hand knowledge and experience of international Communism, and how it operates, they are better informed on how to combat this godless way of life with world domination as its goal. One of the salient points of the Soviet program, initiated some ten years ago, was "to teach the younger generation Soviet doctrine so that it would grow up docile and enthusiastic in support of Soviet rule." This the Soviets have failed to accomplish. Significantly in both Hungary and Poland it has been the youth that have led the uprisings against Soviet domination. In other countries it also can be said that the youth have led the opposition to totalitarian regimes.

Perhaps the greatest contribution FEER has made is in supplying the UN with information which was factually correct, both morally and politically, to give the entire world the truth of the Hungarian uprising. It not only lifted the morale of the Hungarians but it put the onus on the Soviets which later led to the easing of Russian terror against the Hungarians.

In Summary

The point of this editorial is not just to *laud* the Free Europe Committee for their activities but to *acquaint* our readers with the activities of this private, non-profit organization, in the hope that they will better understand what this committe has accomplished since its inception in 1949.

During 1958, realizing that even where freedom of the press exists, Communism can constitute a danger, more emphasis was placed on educating the Free World on the fallacies and pitfalls of Communism.

Perhaps, we in the Army engaged in Public Relations work should take a few tips from this committee so that we can better understand the way of life of our potential enemy. At the same time, armed with the proper knowledge and background of this international menace, which seems to permeate us as an incurable cancer, we could explain to the men in our troop units: Why we must be prepared; why we need an Army; and why we must not allow ourselves to come in —second best. In the struggle for world leadership there will be only one winner. If we believe in our way of life we must be willing to fight for it regardless of the cost.

(U. S. Army)

Toward Better Armor Training Management

The peacetime mission of the Army and Armor is training. Armor Officers should conduct it in the most effective and efficient manner possible.

By DR. ROBERT A. BAKER

ONE of the most difficult tasks confronting the officer assuming the command of an Armor unit is that of putting the current Armor training programs into effective practice. These programs, though carefully planned and theoretically sound, are rarely administered in the recommended or formally prescribed manner. This is not because the unit commander questions the validity of the planning or disagrees with the underlying theory; he simply finds the recommended administrative procedures either inapplicable to his particular unit, or difficult to carry out.

The three-fold purpose of this article is to: more fully discuss the discrepancy between theory and practice; suggest that many of these problems have resulted from the failure to apply many of the tried and true principles of military training management; and offer several practical suggestions to the inexperienced commander for improving his management of Armor training.

According to FM 21-5, *Military Training*, training management is defined as the planning, directing and supervising of military training. Under this general heading are included such things as training responsibility, the Army training system, the development of training plans, training standards, training programs and schedules, and finally, the supervision of training. All of these topics are briefly discussed in the FM cited above. This reference, while it should be carefully read by all concerned with training, was not designed to solve each and every specific training problem arising in the various service branches. Neither was it written to produce skilled training managers and management experts. Instead, this document cites and explains the overall Army training policy and provides general guidance for the preparation and conduct of tactical exercises. It is obvious that within the 47 pages of this manual

DR. ROBERT A. BAKER, a former contributor to *ARMOR*, received his BS and MS degrees from the University of Kentucky and his Doctorate from Stanford University. During World War II he served in Europe with the U. S. Army Air Corps. Subsequently he was a research scientist at Lincoln Laboratory, MIT. He is now a senior scientist at the U. S. Army Armor Human Research Unit, Fort Knox. Since 1954 he has been conducting research on Armor training.

(U. S. Army)

Trainees should be present for and receive all of the instruction geared to teach that which is required by the jobs that the trainees are to perform.

and the seven pages of Chapter 12, FM 17-1, *Armor Operations, Small Units,* presently devoted to training management, little specific advice or guidance about the conduct of Armor training is possible. Specific courses presented at The U. S. Army Armor School, however, are designed to meet this need and to relate general policies to the specific requirements of the Armor training job.

Although such courses are imperative for Armor officers, other curriculum requirements prevent the School from devoting more time to the problems of training and training management. That more attention to training problems is necessary, nevertheless, is clearly recognized. The recognition of a standing need for research in Armor training was one of the factors underlying the establishment of the U. S. Army Armor Human Research Unit at Fort Knox, Kentucky. For the last five years, personnel of this joint CONARC and HumRRO agency have been intimately concerned with the problem of improving the training proficiency of Armor personnel both in the schools and training centers and in the TOE units. Although not specifically concerned with training management, the results of several USAARHRU research projects have shown that the way the training is administered largely determines its success.

Many of the stumbling blocks encountered by individual Armor units in meeting their stated training needs were found to be due to the way in which the training was carried out. In practice, the total number of training hours formally prescribed did not parallel the total number of hours of actual instruction received by the individual trainee. In addition, many units of instruction specified by the formal program were modified or omitted during the actual administration. Moreover, all of the supporting structure of training literature, training aids, tanks, weapons, ranges and cadre assumed by the formal program was seldom in existence at the training centers and the units having the mission of conducting the training. Many other difficulties, in terms of supporting the formal training and in meeting everyday unit requirements, were encountered.

Make no mistake, it is not the intent of this article to belittle the accomplishments of the Armor personnel responsible for the philosophy and the structure of the current formal training programs, Rather, the purpose of emphasizing the disagreement between practice and theory is merely that of clarifying the inability of any type of formal program to solve all the local commander's particular, peculiar and pressing needs. In truth, the formal program is conceived of as a *guide,* and is so labeled.

Yet, when faced with the problem of preparing a tank unit to meet any type of combat emergency, no *guide* will be sufficient in and of itself. In view of the limitations of time, money, space and personnel, the difficulties often appear insurmountable; yet, whether he likes it or not, the commander must overcome them. Keeping his training goals and needs foremost in mind, the small unit commander should study the peculiarities of his particular situation and develop a logical plan of attack for his training mission. Whereas no commander would dare to commit his troops without an intensive and thorough study of his and the enemy's capabilities, many junior commanders often commit themselves to a training mission without having adequately surveyed the training environment. It is believed that this occurs because the junior commander is either unaware of all the necessary requirements or, if aware, he still cannot approach the numerous details in a skilled or experienced manner. In most instances, his formal training in training management has been scant and infrequent, and his informal training has been accumulated at a lower level of command. In addition, training practices and procedures which may have *worked* in the past are no longer as pertinent or as applicable due to the influx of new equipment and matériel, new tactical concepts and new organizational procedures. This situation would not be too serious, however, if it were possible for each and every commander to attend formal classes or to accumulate the practical experience necessary to deal most effectively with each and every innovation. This, unfortunately, cannot be done. There is neither time nor money to provide this sort of training for all people concerned with training management. As a result, the burden of responsibility for planning, directing and supervising must be placed upon the junior commander's lonely shoulders.

If this analysis of the situation is correct, what then can the inexperienced commander do to improve his own effectiveness? The courses of action open to him are few. Yet it is sincerely believed that an honest effort to fully exploit the few available techniques will result in a vast improvement in the effectiveness of whatever training is given.

Any attempt to solve all the commander's management problems within the brief space of this article would

be admittedly futile. Nevertheless, if any one cure-all were to be recommended, it would be that of *careful planning*. In essence, careful planning should contain the following elements: Having received his training mission, the commander should, first, determine what he wants to accomplish—*i.e.*, the training goals; second, he should determine what he is capable of accomplishing with the existing support and available facilities; third, he should reset his initial goals in terms of more realistic goals that he can reach. Next, he should:

1. Ensure that work toward the realistic goals is supported to the fullest;
2. Ensure that the training is as realistic and as effective as possible;
3. Ensure that all officers and noncommissioned officers in his command are imbued with a deep and definite sense of training responsibility, and that all men in his command remain constantly alert to ways and means of improving the training as it is given;
4. Ensure that any training given is properly evaluated,

This is, admittedly, a very large order. Nevertheless, it is believed that every troop commander is not only capable of such planning but also has the potentiality for reaching these objectives.

But how should he actually go about it? This can best be shown by discussing each aspect of the above approach, by looking more closely at the attendant problems and, finally, by suggesting at least one or more solutions to some of the more perplexing problems.

Problem I

What Are the Training Goals?

Although the small unit commander is seldom concerned with the overall Army training policy, he is daily concerned with the attempt to make that policy work. In carrying out this policy, he frequently finds himself with the dilemma of how to prepare the soldier for both a combatant and noncombatant mission. Military planners have emphatically stressed the view that in time of national emergency or full-scale mobilization it is both economically and strategically necessary to train individuals to the maximum degree of proficiency in the minimum amount of time. Thus, it is necessary to weed out all "nice to know" or noncombat-related skills. During peacetime, however, it is also necessary not only to prepare the soldier to do a specific job but also to educate him for the assumption of more technically advanced skills and future promotions. If the "need to know" or specific job-related skills are emphasized, the more general job category skills suffer; if, on the other hand, the more general job category skills are emphasized, the specific or specialist skills suffer. Although it is frequently assumed that both general and specific training can be accomplished within the same time period, in practice this is rarely the case.

Another problem exists with regard to who is responsible for training the soldier to meet his job requirements. For example, many schools and training centers conceive their mission as that of providing the minimum essential branch training, and of laying a firm and broad foundation for mastery at a later date when the student is assigned to his permanent unit. On the other hand, the unit commander has little time, personnel, space or facilities to administer either a formal or informal on-the-job training program and is faced with the ever-present possibility of a combat commitment. Of course, we are not presently engaged in a shooting war and the unit commander is able to provide some on-the-job training for both junior officers and EM. In the event of mobilization, however, specific actions must be taken to resolve the present dilemma and to ensure that the field training and the necessary background for all combat replacements is provided.

Suggested Solution to Problem I.

In FM 17-1, *Armor Operations, Small Units,* Chapter 12, several basic objectives essential to Armor training are listed. Here it is stressed that these general subject areas must receive continuing emphasis at all echelons. It should be noted that the objectives listed are not in essential disagreement with either specific combat-related skills or the more general Armor skills. It is realized, however, that limitations of time and supporting matériel will frequently force the commander to choose between an emphasis on specific combat-related skills or the more general, less essential, non-combat skills. In this event, clearly the specific combat-related skills should be emphasized. Moreover, it is usually more efficient in the long run to learn one job or group of related skills well before proceeding to other jobs or groups of skills.

(U. S. Army)

Good training management places most emphasis on the essential Armor skills.

(U. S. Army)

The unit commander can increase the efficiency of his unit by ensuring that each individual thoroughly understands what is expected of him on the job.

Before any job can be mastered, however, it is imperative that the specific requirements of the job be known. It is frequently noted that many failures to perform essential duties are the direct result of a failure to realize that the duties are actually a part of the job. This is especially true of young and inexperienced officers and noncoms. Here, the unit commander can increase the efficiency of his unit by ensuring that each individual in his command understands exactly what is expected of him on the job.

Problem II

Can the Training Mission be Supported?

Once the commander has received his training mission, determined his training goals and has decided upon a particular plan of action, he should now determine how this plan can best be supported. Too frequently, even the best of plans is frustrated by the number of difficulties standing in the way of making the plan operationally effective. Let us examine some of the more typical difficulties.

A recent study of training, as it was administered at one of the training units, revealed that only 50 percent of the material presented was learned. In addition, it was found that the instructors and cadre actually spent 68 hours a week on the job, as contrasted with the 44 hours scheduled. A thorough study of the reasons underlying these findings showed that many interfering organizational and administrative procedures and a lack of adequate support were chiefly responsible. The instructors were found to be well trained, the lesson plans were well prepared and well presented by standard Army instructional procedures to the extent permitted by existing facilities. The primary causes of poor learning were:

1. Lack of training equipment;
2. Poor classroom facilities;
3. An insufficient number of skilled assistant instructors;
4. Numerous details and housekeeping duties which kept the trainees from the classes;
5. Too many obsolete or inadequate training aids.

Similarly, it was found that it was actually impossible to administer the formal program in the 44-hour week actually scheduled. The elaborate preparations necessary prior to the administration of the training and the extensive housekeeping necessary after the training is given never appear in the formal schedule.

Suggested Solution to Problem II.

Before any suggested solutions to the support problem are made, perhaps *support* should be defined. Support does not mean merely having a sufficient amount of men and a large stockpile of supplies and equipment. Support includes both artifacts and attitudes. Let us look at the things that ideal support for training would consist of. In order for any training program at any level in any training establishment to be maximally effective, the following elements are requisites:

1. Administration *must* exist for the sole purpose of supporting the training mission.
2. The training mission and the training goals must be clearly recognized and constantly kept in mind.
3. Physical facilities in terms of land, buildings, training areas, etc., adequate to support the training mission must be available.
4. The training organization must be so organized that the individuals responsible for conducting the training have optimum and maximum support for the individuals being trained.
5. An adequate (including a sufficient reserve) supply of qualified and well trained instructors must be available.
6. An adequate (including a sufficient reserve) supply of up-to-date equipment must be available.
7. Some formalized training program, that is—a curriculum geared to teach that which is required by the jobs that the trainees are to perform, must be written and carried out.
8. The particular training methods employed should be those that will best conform to the particular skill being taught.
9. The training time in each skill should be the proper amount—*i.e.*, the amount necessary to ensure both learning and retention of the material learned.
10. A method of evaluating and keeping the training up to the training standards and in line with the training goals (*i.e.*, quality control) must be installed.
11. Both instructors and trainees should have their own indi-

vidual up-to-date instructional literature.

12. An adequate supply (to include reserves) of the latest up-to-date training aids should be available and employed.

13. Extra-curricular requirements should *never* be permitted to interfere with or to supplant *any* curricular requirements.

14. *All* trainees should be present for and receive *all* of the instruction. If any failures to attend occur, make-up classes should be scheduled.

It is sincerely believed that all of the requirements listed above are necessary if any training program is to be maximally effective.

The mere fact that one can cite and recommend minimum support requirements for training does not, in any sense of the word, guarantee that it is possible in view of the present situation and administrative circumstances to introduce them into actual unit and training center practice. Budgetary limitations force the units and the training centers to do their best with what they have. An inadequate number of gunnery ranges, limited or inadequate terrain, shortages of funds for training ammunition, POL, etc., logistical difficulty in getting an adequate number of tanks, the costliness of training aids, training films, etc.—all these stand in the way of the successful accomplishment of the training mission. These are things beyond the powers of the individual commander, and require the attention of higher headquarters. Although it is recognized that higher headquarters is often unable to assist in such matters, there are other ways and means within their capabilities by which better support is possible. It is believed that one of the most effective steps would be for higher headquarters personnel to give greater authority and more freedom in the conduct of training to the commanders at lower levels. In addition, they should furnish maximum support to the subordinate units, and inspect only to ensure that the support is provided and that high standards of combat-readiness are set and achieved. Some additional corrective steps that could be taken immediately to truly support on-going training could consist of the following:

1. A reduction in the large number of routine "training inspections" and "visiting firemen" tours by higher echelon personnel.

2. An immediate reduction in the amount of time devoted to preparing for technical inspections such as the Army maintenance inspections, and a placing of these in their proper relationship to other equally important activities.

3. Putting into effect an increase in both the responsibility and freedom for exercise of initiative on the part of the small unit commanders.

4. "Grease" the command line between the Commanding General and the unit commander responsible for training proficiency.

5. Accept, increase and support the theory that administration exists to support training, not vice versa.

6. Radically reduce the demands by higher echelons for details which do not directly contribute to the training mission, and abolish the bulk of details for interior guard duty, etc., that really serve no direct training purpose.

7. Seriously consider contracting civilian firms, etc., for feeding of troops while units are in garrison, firing of furnaces, handling of administrative details and supporting higher echelon maintenance duties.

(U. S. Army)

Good training management ensures that adequate facilities and a sufficient number of the latest up-to-date training aids are available for training.

Problem III

Can the Training be Conducted in a Realistic and Effective Manner?

It is obviously impossible to introduce all the stresses and strains of actual combat into each period of instruction. Even the most carefully planned and realistically performed maneuver cannot succeed in imposing the threat of personal disaster and thus motivate all troops involved. It is also manifest that considerable time, space, personnel and money are required, if any field exercise is to be realistic. It is clear that the specific environmental conditions of combat demand things which cannot be adequately duplicated. Nevertheless, in spite of these obvious limitations and restrictions, more realism in our present training programs can be achieved.

Suggested Solution to Problem III.

Two excellent examples of training that is both realistic and effective are the Tank Crew Proficiency Course and the Tank-Infantry Platoon Combat Course currently employed by the

Seventh U. S. Army Tank Training Center. Although many units are restricted by lack of range space, considerable training value can be attained by dry-firing such courses. In fact, dry-firing exercises can profitably be employed by all units and are limited only by the number of tanks, amount of gasoline, available tank terrain and ingenuity of the instructor personnel. Moreover, tank vs. tank live-firing exercises utilizing subcaliber ammunition are also feasible at some installations. In addition, considerable realism can be attained through the use of three-dimensional targets and mock-ups of tanks, bunkers, trucks, gun emplacements, etc., rather than the standard 6 x 6-foot canvas panels. Personnel of the Armor Human Research Unit are currently developing an inexpensive three-dimensional target which not only furnishes the needed realism but also supplies the gunner with immediate knowledge of results. Increased realism can also be attained through the use of films, film strips or slides. For example, the U. S. Army Training Center: Armor, has recently introduced the photographic display of realistic tank targets into the training of tank crewmen (See "Crew Reaction Training"—*ARMOR*, Nov.-Dec. 1958).

While it remains true that we can only approximate the conditions of combat through the use of such types of synthetic training devices, it is sincerely believed, nevertheless, that significant gains can be made provided we devote additional time and effort to pursuing and maximizing the possibilities existing in these areas.

Problem IV

Can the Individual's Sense of Training Responsibility be Improved?

While everyone can agree that the ability to bring troops to a state of combat-readiness and to maintain a high degree of morale in the face of many physical hardships is a true watermark of the leader's ability, too often the problems facing the commander responsible for training and training proficiency are those which lie outside his ability to do anything about; they are such things as a shortage of trained instructor personnel, a shortage of training areas and range space, directives coming from higher headquarters which do not permit him to accomplish both the training mission and the secondary mission, inadequate facilities and supplies, and a host of impossible personnel problems such as transfers, replacements, TDYs, completion of duty requirements by reservists, etc. The end result is that the individual commander's personal sense of training responsibility is seriously damaged or wholly lost. Shortly thereafter, a similar loss is apparent among the junior officers and senior noncoms.

Suggested Solution to Problem IV.

Since the chain of command is a one-way street, it is the duty and responsibility of the commander to set the example. Here, he must be able to communicate a strong sense of responsibility by setting high yet realistic training standards. Moreover, every individual in his command should be personally impressed with the desire to achieve the training objectives. One of the most effective ways in which this can be done is by both formal and informal briefings. These briefings should state the training goals and the operational plan by which it is hoped to achieve them. Following this, each of the small unit leaders should be assigned the responsibility for planning and conducting their own training exercises. Here the commander should exercise a minimum of supervision; not only will this succeed in developing aggressiveness and self-reliance in the small unit leader, but it will also develop a capability of operating under mission-type orders with a minimum of guidance from above and will serve to increase the small unit commander's own sense of responsibility for the specified training objectives.

It is also recommended that more individual instruction should be given by the small unit leaders since teamwork is essential and leadership is a necessity. Not only does the individual soldier develop confidence and trust in his immediate superior, but the sense of group unity is also enhanced. It is also believed effective to encourage all individuals in the command to make suggestions for improving the efficiency of daily training practices; moreover, when these suggestions are made, additional efforts should be made to further encourage and reward the responsible individuals.

Problem V

Can We Improve Training Evaluation?

Of the five phases of military instruction—preparation, explanation, demonstration, application and examination—in practice, the last seems weakest. Not only is there an inadequate number of valid and reliable examination instruments, but also many of the instruments give the commander little information as to whether or not his training goals are being met. In addition, they too frequently do not afford him the specific information he needs in order to take any sort of corrective action. For example, at the end of the advanced individual training phase of ATP 17-201 there is no formal Army Training Test. Moreover, at the end of the platoon phase of basic unit training, while ATT 17-1 for the tank platoon is provided, an inspection of this test reveals that of a possible 500 points, more than 400 points are devoted to a direct examination of the platoon leader's behavior. Again, in the past when individual stakes-type tests were administered to TOE tank crewmen of a unit—supposedly trained and combat-ready—a lack of proficiency with individual weapons and critical tank skills was uncovered. However, on the annual battalion test, the unit as a whole was given a superior rating. In another instance, a unit that was found to be deficient on platoon and company tests was found to be superior in terms of their knowledge of the individual weapons and their employment when individually tested.

Such discrepancies clearly show much remains to be done in the area of training examination. Specific areas of weakness are:

1. Individual differences with regard to standards of proficiency on the part of observer or umpire personnel;
2. Individual differences as to what is "basic or essential" and what is "nice to know;"
3. A general lack of attention to the details required for the proper administration of a test; and
4. A failure both in the construction of the test and in the evaluation of the test results to provide ways and means by

(U. S. Army)

By testing and retesting, the unit commander can be assured that his training is maximally effective. He can supplement this with personal inspections.

which maximum corrective action can be taken to improve any deficiencies uncovered.

Suggested Solution to Problem V.

Although the unit commander should employ the standard Army Training Tests to the fullest advantage, it is not expected that all evaluation will cease after their administration. The individual commander should maximize their value by supplementing them with his own personal inspections and evaluations not only at the end of a particular phase but also during the training cycle. If the training goals are clear in mind and the desired levels of proficiency are known, each commander—with the assistance of his staff—can construct tests and field exercises which will clearly show whether or not the objectives have been obtained. After the tests are administered and evaluated, considerable value can be obtained through the use of a training seminar in which the results of the tests are made known to all of the training personnel. Here, suggestions for correcting deficiencies and the necessary remedial steps can be agreed upon, and responsibility for additional training assigned.

Only through such systematic procedures of testing and retesting can the commander be assured of the fact that his training is maximally effective. Tests are of no value unless the results are meaningful and lead to some future action.

Problem VI

Can We Improve Training Management?

In many command areas, serious attempts are made to closely control the training program and to insist upon a rigid adherence to the program as written at army or division levels. Yet, in spite of this, it is possible to state with little fear of contradiction that the present formal Army training program, ATP 17-201, has never been actually administered *in its entirety* as it was originally conceived and written. Unfortunately, the many subsequent and constant revisions of these programs contribute practically nothing to the successful accomplishment of the training goals. Again, the programs as interpreted, modified and rewritten in the field at army, corps, division and battalion levels differ most radically from the formal programs published by D/A. In fact, the D/A formal programs specify that they are to be used as "guides." It is also obvious that the designation as "guides" is interpreted differently by different commanders, at different times. If there is, nevertheless, an insistence upon sticking to the formal program at the company level, an attempt is made to do so, but the attempt is usually futile and the "ATP pencil" is frequently employed.

Suggested Solution to Problem VI.

While it is realized that the individual commander's time is at a premium, it is still recommended that the junior commander devote some time to learning more about training management. It is also recommended that the commander increase the amount of time that he spends on programming and planning, and that he take a more active and participating role in the actual conduct of the training. It is his responsibility to train the training officers who will train the trainees. It is also his responsibility to establish and maintain high training standards. In addition, it is necessary that some sort of quality control techniques be instituted in order to ensure that the standards and controls are being met. Too frequently, it is believed, the expedient solution is preferred to the more costly yet superior long-term solution. Higher headquarters personnel should carefully weigh the economic aspects of such solutions. In terms of the final goal of training—combat—failure to learn essential combat skills is an expense we cannot afford.

Summary

Although the foregoing comments are of most pertinence to the relatively inexperienced small unit commander, many more suggestions for the improvement of training management at other levels should be made. Commanders at all levels should continually emphasize the facts that training is the primary peacetime mission of the Army and Armor, and the Armor officer's primary responsibility is to conduct it in the most effective and efficient manner possible. Of further importance is the existing and growing need for a thorough study of how to train our training managers. Such a study could lead to more feasible and efficient solutions to the problems pointed out above, and eventually should lead to an intensification of officer training both at the lower and higher levels of command, in those aspects of training management which would result in good training theory actually being put into administrative practice.

By LIEUTENANT COLONEL ROBERT J. BENNETT

The 1958 Armor Leadership Award

This award is presented every year to the outstanding tank platoon of an armored division designated by the CG, USCONARC to conduct the competition.

THE Seventh United States Army Training Center at Grafenwoehr, Germany provided the environment for the 1958 Armor Leadership Award competition conducted in Europe by the 3d Armored Division, under the command of Major General Thomas F. Van Natta. From 12 to 19 November 1958, five tank platoons of the Spearhead Division competed for the coveted Draper Trophy over the rugged terrain of this Bavarian training area.

The Armor Leadership Award, better known as the Draper Trophy, is presented every year to the outstanding tank platoon of an armored division designated by the CG, USCONARC to conduct the competition. This competitive training exercise was originated by the late Colonel Wickliffe Draper, Cavalry, who established a trust fund of $35,000 for the purpose of developing outstanding small units and their leaders in the U.S. Army. Colonel Draper's trust fund is today administered by personnel at CONARC, through the Draper Combat Leadership Trust Fund and Army Regulation 672-73, under the general sponsorship of the United States Armor Association.

Preparation for the 1958 competition in Europe was launched early in that year upon receipt of a letter at the headquarters of the 3d Armored Division in Frankfurt, Germany from the CG, USCONARC designating the division as the sponsoring organization. This letter specified that all competing platoons must attain the status of training required by ATT 17-1 and comply with AR 672-73. Under this broad guidance, the Division Commander was permitted to use his own discretion in formulating the terms of the training test that would be used to determine the winning platoon in the division.

As a first step in preparation, a Policy and Procedures Board headed by the Assistant Division Commander, Brigadier General James D. Alger, was appointed. This board was charged by the Division Commander with the responsibility for outlining the scope of the exercise, and prescribing the procedures and rules that would govern the competition. The test exercise developed by this board included everything from individual soldier skill events to tank crew and platoon tactical problems simulating combat operations.

Each tank battalion and the Reconnaissance Squadron of the division conducted their own preparatory training for the test under the supervision of the Battalion and Combat Command Commanders. This training was culminated by an intra-battalion competition during which one platoon from each of the participating battalions was selected to compete in the division-sponsored Draper test.

On 7 November 1958 the Draper Test Headquarters commenced operations at the Grafenwoehr Training Area under the guidance of the Test Director, General Alger. Colonel Walter B. Richardson's CCA, then undergoing training at the big training reservation, provided logistical and administrative support for the umpires, aggressors, controllers and the Draper platoons.

Participating platoons were oriented on overall test and umpire control procedures in briefings two days before the test began. They were also told that a four-day period would be used to test each platoon. One platoon would start the competition on each of the first five days in the seven-day period 12-19 November and one platoon would finish the test on each of the last five days of this period. This staggered schedule permitted maximum flexibility and required fewer umpire-controllers than were needed in 1956 and 1957 when shorter periods of time were used for the test by our Draper-predecessors, the 1st and 2d Armored Divisions.

At 0800 on 12 November a Draper Trophy Test opening ceremony was held at the Grafenwoehr Post Theater. At this ceremony, each of the Draper platoon leaders was called forward by General Alger, the Test Director, and asked to draw a number from a tanker's helmet to determine the order in which the platoons would enter the competition. The lead-off platoon was the 1st Platoon, Troop D, 3d Reconnaissance Squadron, 12th Cavalry, commanded by First Lieutenant Ernest Sprinkel. At 0900 Lieutenant Sprinkel and his platoon received their final instructions and at 1000 the test got under way.

Actual testing events were scheduled as follows for each platoon: First day—Each member of the platoon underwent the standard Army Physical Fitness Test and fired the .45 caliber pistol and submachine gun for record; Second day—all competitors participated in the Military Stakes event

LIEUTENANT COLONEL ROBERT J. BENNETT, Armor, received his Infantry commission from OCS in 1942. During World War II he served in Europe with the 6th Armored Division. Integrated in Armor in 1947 he attended Knox and was sent to Korea to the G1 section, Eighth Army. After attendance at C&GSC he was assigned to the Army General School, Fort Riley. After commanding a tank battalion he was G1, X Corps. In 1955 he was assigned to the 3d Armored Division. Test Coordinator for this year's competition, he is presently the Division G2.

(Stars and Stripes)

Deadeye shots of the competing Draper Trophy units gained valuable points in the competition.

An M48 tank passes through fire to score points in competition held at Grafenwoehr, Germany.
(U. S. Army)

(U. S. Army)

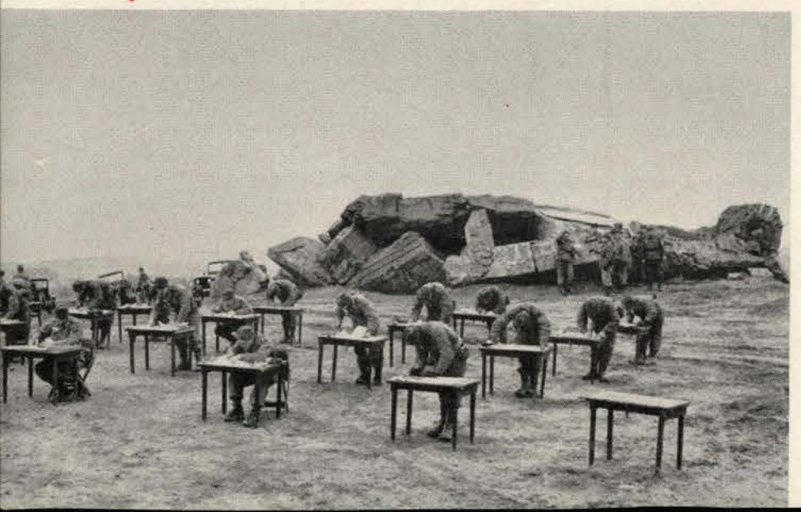
Members of a competing platoon take part in a simulated atomic attack while competing for Draper Trophy.

(U. S. Army)

A simulated casualty is removed from his tank midway in tactical phase of the test.

Grotesque hulk of a blitzed bunker at Grafenwoehr, Germany overshadows men participating in the map-reading test of this annual competition.
(Stars and Stripes)

An Aggressor Armored Personnel Carrier moves into position to harass one of the competing tank platoons.
(U. S. Army)



(U. S. Army)

The winning platoon of the 1958 Draper competition—The 2d platoon, Company D, 1st Medium Tank Battalion, 32d Armor, 3d Armored Division, after trophy presentation.

which consisted of tests of the maintenance proficiency of tank crews, selection of firing positions, making range cards, precision driving, use of radio communications, use of auxiliary fire control instruments, preparation of the tank and its crew for defense against atomic strike, disassembly and assembly of pistols, submachine guns and machine guns, first aid procedures, knowledge of the Code of Conduct and map reading. The afternoon hours of this day were used to put each tank crew through the standard Seventh Army Tank Crew Proficiency Course during which they fired their tank's main armament gun and the .30 and .50 caliber machine guns against surprise targets.

The 3d and 4th days (to include the 3d night) were used to test the platoons on tactical procedures. Before beginning the 34-hour tactical problem, all platoons underwent a complete combat readiness inspection. Detailed observations were made and recorded of the condition of all individual equipment, OVM and the tanks themselves. At the end of this portion of the test, the same crewmen and their tanks were put through the identical inspection routine to determine the adequacy with which they had taken care of their tanks and their equipment under simulated combat conditions. The platoon tactical problem ran the gamut of normal platoon tactics—advance guard, attack, defense, delay and counterattack. The tactical exercise was highlighted by two "wet-run" problems during which the tank gunners fired the standard Table V and a modified Table VII.

The weather was generally good and due to the inherent flexibility of the seven-day schedule, all platoons went through the tests exactly as scheduled except for two minor deviations caused by ground fog and poor observation which resulted in make-up firing of small arms and portions of the tank gunnery for two platoons.

To insure that the best platoon was selected from the five outstanding competitors of the Spearhead Division, the scoring and control of each had to be as constant and as free from human error as possible. This was achieved by designing score sheets for each event in such a way that opinion-type answers were eliminated to the maximum extent possible. Each event was judged by the same umpire-control personnel for each platoon. The tactical problem had three different umpire-control teams which remained with each tested platoon as it underwent identical portions of the field exercise, thus insuring that each platoon was judged against exactly the same standards. Each Draper platoon knew that they were competing to achieve the greatest score possible out of the 5000-point total assigned to the whole test but neither the platoons nor the umpires knew the exact weighted percentage value of any particular event. These weight values were established prior to the test by the Division Commander, General Van Natta, but were known only to the Test Director, his senior assistant and to the Test Statistician. This eliminated any tendencies on the part of the tested platoons to extend themselves on the high-point events and to coast on the low-point events because they did not know which events were the most important point-wise. This fact also helped keep the umpires objective in their treatment of all testees.

Umpires were given extensive schooling and rehearsal in their duties before the test by the Test Director's staff. They were also closely supervised during all portions of the competition by senior controllers. The detailed scenarios, rehearsed aggressor troops and objective check sheets (score sheets), together with careful selection of all umpires, resulted in an eminently fair test which was praised by all participants and observers.

Normal maintenance support was furnished during the course of the tactical problem by a small command post group which accompanied each platoon as it underwent the tactical phase. This support and the excellent maintenance proficiency of the tested platoons paid off. Of the 25 tanks which began the gruelling test in top condition 25 tanks finished. There were breakdowns caused by parts failure, but the combined talents of the crews and the efficiency of the maintenance support put all tanks back in action with a minimum of delay.

Testing ended on 19 November. The identity of the winning platoon was a closely guarded secret until 21 November when it was publicly announced by Major General Van Natta at his field CP in the North German state of Hesse where other portions of the 3d Armored Division were participating in Seventh Army's CPX "Autumn Vanguard." The winner was the 2d Platoon, Company D, 1st Medium Tank Battalion, 32d Armor commanded by First Lieutenant Richard S. Lovelace.

The victors were appropriately recognized by General Van Natta and their military associates at a Combat Command Review at Ray Barracks, Friedberg, Germany when they returned to their home station from the Grafenwoehr Training Area late in December. General Van Natta, in awarding the trophies, said, "Wherever Armor men are the Draper Trophy is known, and to have participated in this event as a member of the winning Draper platoon will mean something to each of you for a very long time to come."

Lieutenant Lovelace received an engraved silver punch bowl, Master Sergeant Tyler B. Adams, Platoon Sergeant, an engraved sterling silver tray and each enlisted man of the platoon was presented an engraved wrist watch in honor of their outstanding achievement. The parent company of the winning platoon was given an engraved plaque and the 1st Medium Tank Battalion, 32d Armor received custody for one year of the perpetuating Draper Trophy, which has been described in past issues of *ARMOR*. The perpetuating trophy will be passed next to the winning unit in the 4th Armored Division, also located in Europe and in the Seventh U.S. Army. The 4th Armored Division has already been designated by CG, USCONARC to sponsor the 1959 competition.

We of the 3d Armored Division owe much to the Draper Trophy. We are a better division because of it. The test pointed up the high value of the small tank unit and its commander. Our tanks—Armor's "cutting edge"—will give a better account of themselves in combat, we believe, because of the comprehensive evaluation this test provided.

The Spearhead Division is proud of its 1958 winner. We wish our brothers in arms, the 4th Armored Division, good luck in the 1959 competition.

(U. S. Army)

Training an Army National Guard Armored Division

By MAJOR GENERAL CLAYTON P. KERR

THE objective of this presentation is to acquaint you with the National Guard program and its place in the reserve structure of the Army.

Briefly I will cover the organization and training of the National Guard and the logistical support required.

I will also discuss the advisor program inasmuch as many of you will probably be concerned with this duty during your military careers.

MAJOR GENERAL CLAYTON P. KERR, a frequent contributor to *ARMOR*, assumed command of the 49th Armored Division, Texas National Guard, this past November. He served in Europe during World War II with the 36th Infantry Division. He was Division Chief of Staff during the Italian Campaign. From 1946 until 1951 he commanded CCB. He next became Division Artillery Commander, a position he held until he was appointed Division Commander. Author of the book entitled *Pointers for Infantry Troop Leaders*, he has attended the Infantry School and C&GSC.

Status of the National Guard

The National Guard constitutes the organized State Militia and is provided by the Constitution. Historically, the states maintained militia of one kind or another for self-defense purposes. The traditional muster day of the militia was a feature of colonial life. In most cases, every able-bodied man was required to report for muster, supplying his own arms and equipment. At best, this resulted in a loose and poorly disciplined local organization, owing allegiance only to the locality.

Our history is replete with records of militia units which served effectively as reserve components of the active colonial armies and as opponents of those armies. In most cases, effective units resulted from effective leadership.

However, it was always admitted that effective organization of the militia could only be accomplished as a result of close cooperation between the states and the Federal Government, but this was not realized until the early part of this century when the Dick Bill became law. This bill laid the foundation of the modern National Guard.

It must be remembered that the National Guard is, first, a State force under control of the Governor as Commander-in-Chief. However, the

National Guard is available to the Federal Government on call or draft. Essentially, State control means that the appointment of officers and recruitment of men is accomplished by the State.

Since no State could maintain military forces for purely State use in the numbers required by the Federal Government, nor in the degree of readiness required, the Federal Government, in fact, controls the National Guard by allocation of a troop basis to each State. Once this allocation has been accepted by the State it cannot be changed without concurrence of the Governor.

In actual practice, therefore, the State nominates the officers who are finally recognized by the Federal Government, and the Federal Government prescribes the standards for appointment, enlistments, training, and organization and also provides the equipment. The main responsibility now exercised by the State is procurement of personnel, administration and furnishing the facilities.

The National Guard is controlled by the Federal Government through the National Guard Bureau, whose chief, a National Guard officer appointed by the President, is the link between the Departments of the Army and Air Force and the Governors.

Organization

A National Guard unit is a local organization. Its personnel must come from a small geographical area. You can well understand that all areas do not furnish personnel of equal quality.

Recruitment is on a voluntary basis, and the prestige of the unit, and especially its commander, is a vital factor in securing enlistments.

The intense local pride and *esprit de corps* of a National Guard unit constitutes the greatest strength of the National Guard.

Recruitment of personnel is, of course, subject to Federal standards and is controlled by the Federal budget, which limits the size of the National Guard and its training.

For many years, before and after World War II, the National Guard unit was responsible for the basic combat training of its recruits. Turnover, in some cases reaching over 30%, limited the unit to a perpetual cycle of recruit training and hindered MOS and basic unit training to a material degree. Some little basic unit training was accomplished during the summer field training period. A few experienced ex-service men joined the National Guard but, even then, it was realized that the National Guard could never attain and maintain the desired degree of readiness required unless the recruits received adequate basic combat training.

Some two years ago a basic combat training program was adopted which requires all non-prior service personnel recruited in the National Guard to enter a six month period of active duty for training at an active army installation.

The National Guard has been able to furnish the personnel to take this training within the limitations of the budget. The difficulty now is that sufficient spaces are not being made available to receive the number of trainees required to overcome attrition. Congress appropriated sufficient money for the program, but these funds have not all been released for the entire program.

The first two of the six months is devoted to basic combat training and the balance to advanced individual training. In the majority of cases the trainees receive MOS training in the specialty desired by the parent unit commander. Some branch and basic unit training is conducted where the MOS program allows time. Where branch training has not been conducted, the trainee must receive this after he returns to his unit, and this does create a training problem in the unit.

The National Guard has been greatly assisted by this program and trainees have uniformly reported both an interesting program and considerate treatment at the training centers. The future of this program depends on money.

Of course, the National Guard can enlist obligors, those men who have had two years active duty but have not fulfilled their reserve service obligation. While a number of these obligors have been enlisted, the figure in no way reaches that necessary to maintain the units at required strength. In fact, the success of this program is based on wishful thinking. We certainly cannot depend on this group to maintain our strength. We still must depend on the young men who have had no prior service.

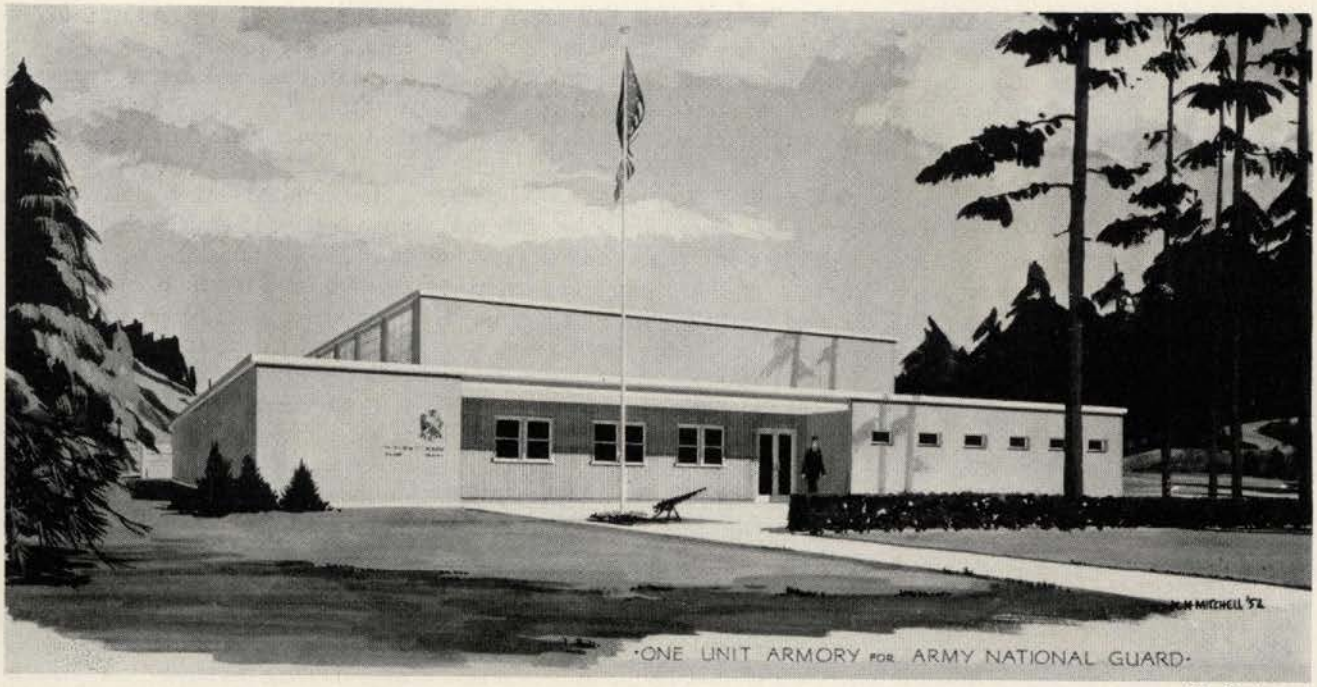
You may wonder why I have discussed recruitment at this length. I say again that Guardsmen are volunteers and the local unit commander must be his own recruiting officer, his own replacement center and his own G1. If he does not have the men he cannot conduct his training properly. So the local unit commander must expend much of his energy in securing personnel instead of putting all his energy on training. It must be thoroughly understood that recruitment is the problem of the local unit commander, that the factors of the local economy and working conditions are important and that, in the long run, recruitment in sufficient numbers results only from leadership of the local unit commander.

Tied in with recruitment is the turnover of personnel. While the turnover varies from one community to another, depending on the local economic situation, the rate has generally been decreasing each year, and now averages just under 30% annually on the National basis. At times the rate of turnover greatly accelerates in a particular unit as the result of the shut-down of a large industrial plant in a locality depending on the plant for most of the local employment opportunities. Some units have had a large turnover because of prolonged drought resulting in population shifts. Where employment is steady, the turnover rate is low and many Guardsmen serve several enlistments and the reenlistment rate is high.

Discipline in the National Guard varies from state to state. Most states with State laws in operation have a more rigid system than that prescribed by Federal law. Prompt action is generally taken against men who miss drill formations. The average of armory drill attendance is about 90%, while the attendance at annual field training runs about 95%. So, discipline is not a serious factor affecting training.

The National Guard procures its officers principally from three sources:

1. Officers who have had active duty and still have a service obligation.
2. Officers of other components who are already commissioned.
3. National Guardsmen who



(U. S. Army)

Single unit armories such as the one shown above are Federal-State projects and cost from $70,000 to over $150,000.

qualify by graduating from the regular or special OCS at Sill or Benning, or one of the State OCS accredited by the National Guard Bureau.

Some 43 states now operate State OCS and the course is prescribed by the Department of the Army.

The three sources of officer personnel procurement are providing barely sufficient numbers, especially in young officers of company grades.

The professional educational requirements for promotion of National Guard officers are prescribed by National Guard Regulations and generally require completion of the appropriate courses at the service school, either on a resident or extension basis. This raises the professional level to that demanded by the active army.

Training

All National Guard training is aimed at mobilization readiness, within limitations of maximum authorized strength.

Since October 1, 1958 in accordance with USCONARC directives, the National Guard devotes all its energies to the unit training phase. For all intents and purposes the National Guard is finished with basic combat training. With few exceptions the advanced individual branch training has been completed. A large part of MOS training also has been completed and this MOS training will be continued concurrently with basic unit training. Branch training, as well as MOS training, will be a continuing requirement within all units.

It is believed that by the close of the 1959 annual active duty training period, that part of basic unit training, to include reinforced platoon exercises, will be largely completed.

National Guard training generally now called annual active duty training falls under two headings, armory training and summer field training, now called annual active duty training.

Forty-eight assemblies for armory training must be held each year. These normally have been of two hours duration, totaling 96 hours per year. However, in order to increase training time available, most units hold either four or eight hour drills in lieu of some two hour drills, very few of which are multiple drills. In my division the minimum training time is set at 124 hours per year of armory drills. Week-ends, mostly Sundays, are used for four or eight hour drills.

Subsistence is available for units holding an eight hour drill. This fiscal year a total of nine meals per man is authorized.

Most four and eight hour drills are conducted outdoors and, where facilities are available, the units complete much of the individual weapons firing requirements and some small unit exercises.

It will be of interest to you to know that about half of the National Guard units are housed in modern, specially designed armories. The others are in facilities provided by the State, usually on a rental basis, or, in some cases, old Federal installations.

Armories are constructed as a joint Federal-State project. The states supply the site and utilities and at least 25% of the cost of the building, the remainder being Federal support. In most cases, the cost of the completed project will run about 40-60 in State and Federal funds.

The majority of our armories are one and two unit facilities; and the cost of the buildings in my State has run from $70,000 to over $150,000 for single unit armories, depending on site and size.

Armories are provided with most of the acceptable training aids such as blackboards, tables and chairs. Also, the National Guard can and does avail itself of the facilities of the Training Aids Center in the various Army areas, which renders prompt

and efficient service when called upon.

In addition, all armories have been furnished view-graphs, moving picture machines and other training aids procured and issued by the National Guard Bureau.

Of course, the most important of the training aids is the actual unit equipment. In most cases the issue of equipment, including weapons of all types, combat vehicles and communication equipment, is in sufficient quantity for armory training.

In general, the equipment is as up-to-date as that issued to active army units.

The normal two hour armory drill is divided into two periods of instruction of 50 minutes each, and a 20 minute period for inspection, preventive maintenance operations, close order drill, etc.

Much of this instruction is classroom instruction and does not give sufficient practice or application, though, when properly used, can provide the basic instruction for application at a following period conducted outdoors during the week-end drill.

The four hour or eight hour drill conducted on Sunday permits the unit to really apply the instruction given in armory drill classrooms, provides for continuity of instruction and is much preferred by many units.

The normal practice is to hold two two-hour drills and one week-end drill of either four or eight hours duration per month.

In order to conduct training in many subjects, there must be much preparation on the part of the unit. We have found that the unit commander needed assistance in constructing a suitable training program so that he could give his time to the conduct of the training.

It was decided that the best help which could be rendered to the unit commander would be to assemble in one document the training requirements with proper references and a training record.

This system has been completed so that the unit commander has in his possession a complete directive for the training of each individual according to his MOS from basic combat training through Basic Unit Training. This directive is also used as an individual training record. (See page 26, September-October, 1958, *ARMOR*.)

We have found that prescribing training directives in some detail is helpful also in raising the training level to the desired standard. The set of training records on each individual is currently maintained in the unit, thus making it possible to schedule any instruction missed by the individual for any reason and to provide a base for the testing program prescribed for the division. It is stressed that adequate testing be accomplished in all phases of the training, using either tests available in the Army Subject Schedules or tests prepared by school trained officers and issued by division.

By using this standard form of training record, which is also the training directive, we can account for every hour of training time, eliminate useless repetition of training, which is a loss of valuable training time and is boring to the trainee, and can be assured of progress in training.

Under present National Guard Regulations, promotion depends not only on time in grade but on qualifications in the MOS required for the higher grade. In the 49th Armored Division we require that award of MOS and skill digits must be accomplished by orders and that all of the prescribed training, including testing, must be accomplished properly.

So, our system of a training directive, combined with a training record, accomplishes several results without too much strain.

Let me stress here that the training directives and training records used during the armory drill year also are used during annual active duty training. The training directed is not just training during armory drill but is a requirement which must be met regardless. It is apparent that some of the training can be completed at armory drill and some must be postponed until summer camp. For these reasons I will not further discuss either the system of directives or records in connection with annual active duty for training.

Scattered over the State we have some outdoor training areas in proximity to home stations. Units move to these areas on week-end drills and can conduct basic unit training. For instance, we have over 9,000 acres at old Camp Maxey, 3,000 acres at Eagle Mountain Lake, and suitable areas at old Camp Swift and Camp Bowie. Also, where units are too far removed to use any of these large areas, smaller local areas are generally available. So you see that we actually can conduct basic unit training on a broad scale.

The annual active duty training period covers 15 days, excluding travel time. More travel time is allowed, depending on travel distance.

From the time of assembly at the armory to return and dismissal after maintenance of equipment, the unit is in a training status. Actually the motor movement to the training site is conducted as an exercise, as is the return movement.

Two full weeks at camp produces about 88 hours training time, to which is added the training received during the motor movements to and from home station. The actual scheduled training occupying the majority of the men is about 100 hours.

It will then be seen that the total scheduled training time for the year, including armory and field training, amounts to about 220 hours. Compare this available time to the hours prescribed in the ATP's and we find that it will take several years to give any one soldier his proper training, according to hours. However, time is gained by conducting much of the training as integrated training, especially at summer camp. Every opportunity is taken to integrate training. For instance, training in motor marches can well integrate training in camouflage, defense against air attack, vehicular maintenance and other items. Conduct of such integrated training requires careful planning and much supervision of execution, but it is well worth the effort, keeping men alert and interested to the extent that they absorb, with little effort, much of what they must learn.

The summer camps are conducted at either active army sites or state-owned sites. The suitability of these sites presents problems which are not easily solved. In some cases the sites are really too small for the units conducting basic unit training to be accommodated in the number required. In some cases, weapons firing and basic unit training exercises cannot be conducted at the same time.

Luckily, our division uses the Fort Hood facilities, but these are rapidly becoming inadequate for a complete

division and the active army troops stationed there.

In the troop areas the facilities usually are of the minimum field requirements—tents for troop quarters, which is fine—but we have a shortage of kitchens so that two or more messes must be consolidated in many cases. While the people of the active army are doing everything possible to correct bad situations, the limitation on spending results in deferring much needed construction. I want you to know that we are thankful for what we can get, but that we think there is a minimum requirement which must eventually be met.

The general program consists of tactical training and weapons firing. While units complete what firing they can at home station, most of the crew-served weapons can be fired only at summer camp. Some small arms firing must be done at camp. When train-fire is started, all such firing must be done at summer camp because adequate ranges will not be available at home station.

Service practice for the artillery and tanks, of course, must be accomplished at summer camp. The only limitation generally on this firing is time available, for we usually have sufficient weapons and ammunition available. This gunnery training is the most popular training conducted at camp, and rightly so.

The Fort Hood ranges include the Individual-Tank Course and the Tank-Infantry Combat Course, and other specially prepared range facilities. Careful planning is required to insure continuous and effective use of the ranges.

While the units have sufficient weapons and equipment at home station for armory drill training, the majority of heavy weapons and combat vehicles are maintained in a State Field Operated Equipment Concentration Site at the field training site, inasmuch as the cost of shipping heavy weapons and combat vehicles from home stations is prohibitive.

The equipment in the concentration site, in our case at least, is sufficient for our field training requirements. Tank companies can secure the number of tanks they can man. Artillery batteries generally have four pieces. The units draw the equipment from the concentration site on the first day and return it on the last day, being responsible, of course, for all maintenance during the camp period. This maintenance is performed by our organic means, from user to ordnance battalion, both in the camp area and the field.

It can then be said that the National Guard Armored Division actually operates and maintains almost 100% of the equipment authorized, predicated on the personnel strength available.

Combined arms training is conducted whenever possible. The battalion support elements such as scouts, mortars, medics, maintenance and supply, perform their proper function during Tank-Infantry platoon exercises. The staffs get considerable tactical experience in planning for and executing the integrated training of subordinate units.

We do not need material support to move to camp, except some buses for personnel, and during camp we operate as a division in all respects from ration breakdown to the kitchen, battalion dispensaries; from the motor pool to field exercises, including our own organic aviation.

The logistical support furnished by the active army consists of preparation of the camp site, utilities and furnishing equipment not otherwise available. It must be stressed that division personnel operate the equipment and maintain it.

We are proud of the fact that we can move, shoot, communicate and maintain as a division with our present strength of over 8,000.

The plans of the division for summer training are prepared by the division in accordance with current Army directives. Coordination of such plans is effected at all levels and the execution of the plans is a division responsibility, and we can and do accomplish the job.

The training conducted at camp is recorded on the training record of the individual as it is during the armory training period. So we just have one training record and, since I have mentioned our system previously, I will not further dwell on it.

The Army commander details an Evaluation Board of Officers to observe the conduct of field training of the division. Generally, at least one officer works with each battalion. This board continually observes the division in all its activities from arrival in camp to departure. Many thousand observations are made and recorded. Every unit knows each day the items reported on, either good or bad, from kitchen police to service practice, from saluting to motor maintenance. These active duty officers make pertinent suggestions for improvements in operation, criticize poor performance and issue praise where warranted.

We consider this Evaluation Board as one of the best of training aids, even though the members are generally referred to as "Green Hornets," which refers both to the color of the helmets they wear and the needles they sometimes use. We like their work so much that we are pleased to have these people later detailed as advisors to the division. These boards are additional eyes and ears of the Division Commander and staff, and their work is invaluable to the division. It is this group which renders the annual evaluation of the units to the Army Commander. Last summer the board rated 17 units "superior," 32 "excellent," 37 "very satisfactory," 24 "satisfactory," and two "unsatisfactory," all compared with active army units.

To give you some idea of the scope of the summer camp training, the principal items of equipment actually

EQUIPMENT—FIELD TRAINING 1958

Tanks, All Types	159
APC	95
Howitzers	36
AAA Weapons	18

FUEL CONSUMPTION—170,202 gal

used and maintained are shown on the chart on page 39. You will note from the fuel consumption that these vehicles were actually used in the field, not just kept in motor pools.

Extra Training

One of the main items of National Guard training is that which we might call bonus training, or training received by individuals at other than armory drills or summer camps.

There are generally four main types of this training and, as each is very important, each will be discussed.

We fully realize that no unit can function properly unless its members receive proper MOS training, especially in the critical specialties.

In addition to the MOS training conducted by the units at armory drill and summer camp, many Guardsmen take advantage of special courses offered at service schools to secure this training. These schools conduct courses running from a few days to several months. The students are selected people. This is our best source of MOS trained personnel.

Then we have a considerable number of permanent duty personnel in the Division, ranging from maintenance personnel to photographers. These permanent duty people actually occupy TOE positions in the units and practice every day the specialty they will perform on mobilization. Most of these permanent duty people are graduates of resident courses at service schools or have civilian experience qualifying them in their specialty. In this way we secure MOS qualification of a number of key individuals.

The most important training outside the regular drills is the resident training conducted at service schools, especially for our officers. This training is generally available in all of the resident courses conducted, from MOS training through all of the service schools right up to include the War College.

We consider the service school resident courses the very best way to qualify people for their assigned jobs, as well as for promotion.

In the last 12 years hundreds of our people have received resident training at service schools.

A very large percentage of our officers in Armor are graduates from Knox, more in fact than from any other service school. And without throwing any bouquets around, this is because the school here is what we call a can-do outfit, always ready to meet our normal and special needs, conducting courses as we request. Of course, this ability of the Armor School to be flexible is one of the inherent characteristics of Armor, but just the same, credit is due for a fine job of work throughout these past years.

Some of you may not know that originally there were only two National Guard Armored Divisions and, during those years, the Armor School gave us lots of attention. However, when four Infantry Divisions were converted to Armor, the school here took on the job of retraining this converted personnel by the hundreds on a crash basis, so that the conversion to Armor was pleasant, and effective divisions were created quickly. I have talked with the people in these divisions and I assure you they have nothing but the highest praise for the job accomplished by the Armor School.

Of course, I do not mean to infer that the other service schools fail in any way to render all of the support they can, but the fact remains that those of us in Armor can be thankful for and proud of our can-do Armor School.

The Army Extension Course System is widely utilized in the National Guard for training individuals. I am sure it would be easier to get the same instruction in a resident course, but when we consider the number of hours which people put in on extension courses, all on their own time, this becomes very important.

We have just recently secured approval of a plan to utilize the Army Extension Course System for training some critical specialists on an individual basis. All the time spent on such training outside of regular drills or camp is just so much bonus.

When people cannot attend resident service school courses, the extension course system can be utilized for securing the educational qualifications required for promotion. Of course, many Guardsmen just cannot get away from their civil jobs to attend resident courses.

Some of our units require enlisted men to complete specified extension courses for promotion purposes. Many men take the courses simply because they are interesting and instructive. We specify, from time to time, certain courses to be completed by certain individuals, such as a course on special weapons use.

I do not have the figures on the total enrollment within my division, or the number of lessons completed. I do know that my artillery had over 700 active students last year.

Tactical training of the staffs, from battalion to division, is conducted throughout the armory training year as well as at summer camp. The staffs participate fully in the Army CPX, which extends over several months each year, and begins with the planning for execution of a particular mission, to include the preparation of orders and overlays, and actually playing the exercise.

Each staff is assembled at least once a month for combined staff training. This may be conducting a problem prepared at a service school or staffing an exercise prepared as a training vehicle for a subordinate unit.

Certain selected members of the Division Staff attend a week's refresher course as a staff each year at the Command and General Staff College. Many officers attend refresher courses as individuals at Armor, Artillery and Infantry and other schools each year.

I cannot give too much importance to this most valuable training aid, nor too much praise to the people who conduct these courses.

On a somewhat more limited basis, various Army Area Schools are available to us when funds are available. These schools are conducted for mess personnel, critical specialists and especially for NCO's on leadership. Since such schools are normally of short duration, it is relatively easy to fill the quotas, for most officers and men can get away from their civil jobs for a week or so. We think the Army Area School program should be enlarged if the funds can be secured.

The Advisor

Now, the role of the advisor in the training of the National Guard must be discussed, and I have not neglected to do so before because of lack of importance. In fact, the advisor is the one individual who encourages

the unit to use all of the types of training discussed previously.

Each major command and battalion of the Division has an assigned officer and noncommissioned officer advisor of the active army in appropriate grade and branch. Since most advisors have had recent active army schooling and/or experience in similar units, they bring advice and assistance to their units on the latest techniques and doctrines. They further possess the advantage of full time duty which greatly extends the observation and assistance to scattered units which part time commanders and staffs are unable to perform. The interest of the advisor is as broad as the commander's, but, since neither commands the other, they operate on a basis of mutual cooperation. As you can imagine, this calls for the exercise of the highest leadership on the part of both. The advisor is an important member of the team and his contribution is limited only by the ability, character and personality of himself and the commander.

His working hours are often long and irregular since he must guide on his unit. He attends the week-night and week-end drills and staff assemblies of his units as well as summer field training and certain active army schools. The advisor generates much creative thinking for his unit and has the time to accomplish certain staff writing such as CPX and unit schools in which he actively participates. His mission is as rewarding as it is challenging and represents an important part of our nation's first line of defense, the Army National Guard of the United States.

Logistics and Administration

Logistics and administration always have had an important bearing on training.

We have what is known as a technician program. Members of the unit are employed on a full time basis as maintenance personnel, administrative and supply specialists, training officers and staff assistants. A total of 236 people are so employed in my division.

These people accomplish the day-to-day administrative, supply and maintenance functions of the division from division level down to companies and batteries. But the most important thing about them is that they are assigned to and perform the jobs they will be called upon to do at mobilization. They, therefore, constitute a most important cadre.

The maintenance personnel man organization maintenance shops, usually one in each battalion. These shops operate under supervision of the battalion commanders. In this way the important item of maintenance is emphasized by the commander. His active supervision is exercised by his full time officer staff assistant. Without such a maintenance organization on permanent duty, the units would be unable to properly maintain the equipment.

Backing up the Organizational Maintenance Shops is the State Maintenance Organization with several shops and sub-shops. These likewise are manned by Guardsmen holding TOE positions, usually in the Ordnance Battalion, and all doing daily what they will do on mobilization.

The technician program is supported by Federal funds. Service school training is utilized where possible to qualify these people in their proper MOS.

The program is a most important factor in maintaining a state of readiness, costing something over a half-million dollars per year in my division alone.

The supply system of the National Guard is peculiar in that, except at camp for certain classes, the channel is directly from the U. S. Property and Fiscal Officer for the State to the company commander. Consequently, commanders at a higher level are not brought into the picture, nor are their S4's. The State makes periodic inventories of property and transfers, etc. This system will, of course, have to be changed on mobilization and will probably cause the confusion we had on mobilization in 1940, when the unit supply people were required to make the change overnight. However, certain steps have been taken to minimize the confusion.

During the summer camp period, however, supply of rations, ammunition, and fuel is handled normally, and by our organic units.

It must be borne in mind that everything in the National Guard, as in the active army, is controlled by the Budget.

Training Status of an Armored Division

Since our only excuse for being is to fulfill our training mission of readiness for mobilization, I will give you a statement of the results of our last 10 years. I cannot tell you in detail about the other armored divisions, but I daresay they are much alike.

We consider, as stated in our last readiness report, that we had over 60% of full TOE strength (not our authorized strength), and that over 90% had been in the division over one year. Of our actual strength over 75% are POR qualified.

Eighty-seven percent of the assigned strength has completed basic combat training and 68% has completed advanced individual training. Only 19% has completed basic unit training, and some 15% has completed advanced unit and field exercise training.

Under the projected reorganization to ROCAD, my division will be authorized to maintain a strength of 71% of the full TOE column. We feel we can do this with the support of the six-month training program.

To summarize, the training of a National Guard Division depends on effective recruitment, suitable home station and armory facilities, adequate logistical support, timely planning and efficient execution of the program. The important spoke in the wheel is the local unit commander and local prestige resulting in *esprit de corps*.

You must excuse any apparent flag-waving in this discussion for, while I am a National Guardsman, I am also one who is proud to be a member of our National Defense Team.

The material for this article was obtained from a speech which the author recently delivered to the Advance Class at the U. S. Army Armor School. Although specifics may vary, from State to State, the primary mission remains the same—prepare units and individuals for combat.

This is How it's Done!

For this *Reconnoitering* column we thought that many of you would be interested in a brief explanation of how your editorial staff, consisting of four people, put *ARMOR* together and get it to you in the final form you are now reading.

The first and most important step in the preparation of the magazine is to select material which will be of professional value to the majority of our readers. This important task falls to the editor. Out of the many manuscripts which are constantly being received in the editorial office, we must select those having the greatest value to the majority; covering not only our branch but the Army in general as well. These articles must be instructive, provocative, timely and interesting. Sometimes it is difficult to have all articles meet these desired requirements. In many instances we have to arrange to get articles we feel are needed. Usually this material is obtained by the editor writing to the individual he feels is best qualified by experience to cover the subject and asking him to do a piece for *ARMOR*. This enables us to keep an even balance of material in the magazine. Also, by having the editorial office located here in Washington, D. C. we are able to see a great many of the news releases from various government agencies which might be of interest. From these we are able to publish timely information relative to our branch such as new equipment, organizational changes, etc. This type material particularly applies to News Notes and the Newsletter. After carefully selecting the articles which we will use in a particular issue, we proceed to take out the blue pencil and begin the job of editing and marking the copy for type. The articles are then entered on a "log" maintained in the editorial office. From this log the editor, at a quick glance, can readily see to what step of preparation each article has progressed. After the articles have been entered on the editor's log they are sent to the printer to be set in the type, size and style desired.

Our magazine has been printed by the firm of Garrett & Massie, Inc., located in Richmond, Virginia, for many years. This fine printing house specializes in magazine publishing and can handle press runs of up to 100,000 copies. They are also equipped to handle process color work and are responsible for the many excellent color covers which have appeared on *ARMOR* through the years. We would be remiss if we did not mention the excellent engravings prepared for the magazine by the Virginia Engraving Company also located in Richmond.

When these edited manuscripts are received at the printing plant they are logged in and placed on the *ARMOR* work schedule. The manuscripts are then sent out to the shop where the copy is set in type. This operation falls to one of the linotype operators. From the original edited copy the linotype operator makes up the copy on "lead slugs" from the linotype machine. These lead slugs are then arranged in long galley trays. These trays of copy are placed on the proof press and a set of galley sheets are

printed. These galley sheets are then sent to the proofreading room where they are carefully proofread. Upon completion of proofing, two sets of the galley sheets are returned to our editorial office. The set containing the proofreader's marks is used to indicate any desired corrections. The other set of galley sheets, unmarked, are used for pasting up a set of dummy pages of the article.

The dummy page-up, prepared in our editorial office, is used at the printing plant as a blueprint. It simply shows them how we want them to make up any particular page. Information, such as what size and style of type we want for titles and sub-titles, and where to place photographs, charts and other illustrative material that we happen to be using with the article, is shown on it. This dummy page not only tells the printer how we want the page made up; it also gives us a good idea of how it will look when it is in its final form. When the dummy page-up of the article is completed it is returned to the printer along with the marked set of galley sheets to show any copy corrections desired. In the hands of the printer for the second time now, it falls into the hands of the compositor. The pictures and charts are sent to the engraver for plate making.

The compositor, using our dummy page-up as his blueprint, now proceeds to make up the pages exactly as we have indicated, placing titles, engravings and charts, if any, in their proper place in a page frame and then drops in the lines of type from the galley tray. After he has completed the make-up of a page he takes the page frame to the proof press and runs off a set of printed page proofs. These page proofs are then sent to the proofreading room for corrections and returned to our editorial office for any corrections or adjustments.

When 64 or more individual pages have been made up in a similar manner, all corrections and final adjustments are made here in the editorial office, and a final page proof is in the hands of Garrett & Massie, the big job of actually printing the magazine gets under way.

Without getting technical about it, let it suffice to say that four big frames containing 16 pages each are made ready. Sixteen pages go on each side of 36 x 48 inch sheets of enamel paper, a total of 32 pages to the sheet. These sheets are then run through the big printing presses and after drying are sent to the folder for folding into 32-page signatures.

Meanwhile let's not forget that *ARMOR* has a cover. So while these signatures are run off, our cover, which consists of the front, inside front, inside back and back covers is being run off on a separate press. After the covers are dried and varnished the final steps are ready to begin.

These final steps are an assembly line operation that drops the first signature down, places the second signature over it, inserts the subscription card, and then drops the cover over the second signature to make up a complete unit. This complete unit is then passed along through a stitcher, to the trimming knife, where the right, top and bottom margin is trimmed. The finished magazine then rolls out ready for mailing.

The mailing is done by individual envelope and bulk packages. The envelopes and labels used on packages are run off in the editorial office on an addressograph machine. These are then sent to the printer where magazines are placed in the envelopes and bulk packages prepared. From there they are delivered into your hands by the postman, provided you have kept us informed of your current address.

While on the subject, the problem of address changes continues to plague our Circulation Manager. It seems that no matter how often we ask, a small percentage of members fail to send us a change of address and then want to know why they have not been receiving the magazine. We urge each member to send in a change of address no matter how minor, even if it is only a change from A to B company.

That's about it. Although we have not gone into too much detail, we certainly hope that we have succeeded in presenting you with a fairly good idea of the amount of time and effort it takes on the part of your staff, and the printer, to get this copy of *ARMOR* in your hands.

(U. S. Army)

Gasoline Economy for Armor

By HOWARD C. OLSON

It is obvious that the cost of fuel is no minor item, in garrison or in the field. Any fuel economy which can be effected by Armor has financial, as well as logistical and tactical, advantages.

ARMOR'S strength is in its firepower and its mobility. Firepower requires a good weapons system and gunnery skills to get the most out of the projectiles we fling toward a target. Mobility requires a good automotive system and (some often neglected) driving and maintenance skills to get full benefit from the gas we burn. Here are some tips on how we can save fuel and have more efficient and longer-lived vehicles.

Introduction

Given: A conventional automobile operating under its own power.

Goal: Fuel economy.

Result: A startling 150 miles to a gallon of gasoline!

This result is an actual one. It was accomplished with neither a standard Army vehicle nor a standard civilian vehicle. It was done with a 1948 Studebaker over a closed 43-mile course. And to accomplish it, such practices were used as shaving down the block to increase the compression ratio to 10 to 1, inflating the tires to a pressure of 110 pounds per square inch, grinding off all of the tire tread, and driving at an erratic speed averaging 16 miles per hour.

In the national gasoline economy runs, fuel consumption rates of 30 to 50 miles per gallon are common. Furthermore, in these contests no major change in the automobile is permitted—just the best maintenance and driving procedures known are put into practice.

In the military setting many of these practices would be difficult to implement. For example, the company motor officer might feel that he was somewhat overburdened if he had to supervise the waxing of fan blades to cut down air drag! The Ordnance people might object to disconnecting tail pipes and mufflers to reduce exhaust back pressure! And the truck driver might feel imposed on if he were ordered to drive with windows always closed so as to reduce air resistance!

After all, of what importance to the Army are these fuel economy techniques? The military driver might use only a few of them. But the point is this—that even a few effective ones can be of great significance. Considering an Armored Division, for example, there are more than 1,000 track vehicles and about 2,300 general purpose wheel vehicles. To go 100 miles on roads will require roughly 200,000 gallons of gasoline; cross-country, 500,000 gallons. At Fort Knox during the current year 1,300 track vehicles and 3,700 general purpose vehicles used more than 6 million gallons of gasoline. At current contract prices, this amount represents close to a million dollars. Obviously, fuel cost is no minor item, in garrison or in the field. Any fuel economy which can be effected by Armor has financial, as well as logistical and tactical, advantages.

Ways to Reduce Fuel Costs

This tremendous fuel consumption can be reduced by all the personnel concerned: by the maintenance personnel, who are charged with keeping the vehicles in good running order; by the operators, who should exercise good driving and first echelon maintenance practices; by the crew members, whose crew practices may conserve fuel; and by commanders, who can promote and maintain an attitude of economy. All of these personnel can be effective in reducing fuel consumption.

Let us consider the part each can play in developing an effective fuel economy program.

Maintenance Practices Which Will Save Fuel

Keep the Air Cleaner Clean. A dirty air cleaner can increase fuel consumption by as much as ten percent, for not enough air can be pulled into the carburetor and the air-gas mixture is therefore too rich. Excessive smoke from the exhaust and loss of power are symptoms of a dirty air cleaner. Dust and atmospheric conditions will determine how often it should be cleaned. The oil reservoir should not be too full, or else the same effect as a dirty air cleaner will result.

Keep Carburetion Components Adjusted Properly. Such symptoms as too rapid idling of the engine, or of excessive flame or smoke from the exhaust may indicate too rich an air-gas mixture. When making carburetion adjustments and when synchronizing the tank throttle linkage, a vacuum gauge should be used to make certain that an efficient idling speed and air-gas mixture is obtained.

Don't Let Engine Flood. Excessive smoking and excessive flame from the tank exhaust are symptoms that too much fuel is being delivered to the engine. Improper float level or a worn needle valve or seat may be the cause. The same symptom may be produced by over-choking or by improper positioning of the choke valve.

Keep Spark Plugs Cleaned and Properly Gapped. An engine which does not operate smoothly and which "cuts out" at high speeds shows symp-

HOWARD C. OLSON received BS and MS degrees from North Dakota State and North Carolina State Colleges respectively. He is a Lieutenant Colonel in the active Army Reserve. He has been a Research Psychologist with HumRRO, Fort Knox for six years. He has dealt with training problems in range determination, night operations and driving and maintenance. Now he is determining the human factors bearing on the span of control of a tank platoon leader.

toms of defective plugs. When plugs are cleaned, make certain they are gapped to latest official specifications.

Check Magneto Functioning. If the engine is backfiring or running rough or if only one bank of the engine is operating, there may be magneto malfunction. This, of course, results in power loss and excessive fuel usage; organization mechanics should correct it.

Keep Engine in Time. Difficulty in starting, rough running and backfiring are characteristics of poor valve and ignition timing. When this happens, the engine is not delivering the horsepower of which it is capable. Bad ignition timing generally will develop gradually, while poor valve timing will develop suddenly, usually after servicing. Here again, in addition to the timing light, a vacuum gauge is an important tool to aid in timing properly.

Check Valve Operation. Burned, sticking or warped valves may be indicated when the engine operates roughly and loses power, or when one valve cover is cooler than the others. In such a case, the engine is not receiving full power from this cylinder; organization mechanics should correct the deficiency.

Maintain Proper Band Adjustment in Tank Transmission. Improper oil level in the transmission may result in slippage, as may too loose adjustment of the bands. Another symptom of this is that the tank will not operate in low range or in reverse.

Keep Proper Oil Level in Tank Transmission. Symptoms of lack of oil in the transmission are overheating of the transmission and difficulty in steering. In steering, the tank may react slowly, erratically, or even fail completely on one track. Keeping the transmission filled to the proper level will reduce this power loss.

Be Sure Oil Coolers are Functioning Properly. Overheating causes the oil to become too thin, resulting in excessive engine wear. An inoperative bypass valve or pressure-relief valve, or an obstruction caused by foreign matter (such as leaves, rags, etc.) leads to improper circulation of the oil, which leads in turn to overheating. The cause should be determined and corrected.

Keep Exhaust Unobstructed. Any exhaust back pressure results in loss of power so make certain that mufflers, exhaust and tailpipes are free of extraneous material and that tailpipes are not excessively dented or pinched.

Insure Proper Track Tension and Tire Pressure. If tracks are too tight or too loose, extra power is required to move the track vehicle; and if tires are under-inflated, extra power is required to move the wheel vehicle. Proper or slightly overinflated tires will help to decrease fuel consumption in wheel vehicles, for power requirement increases 15% for every four pounds per square inch decrease in tire pressure.

Use Proper Weight Oil and Grease. The use of too heavy oil and grease in the transmission or differential uses up some of the available horsepower. The use of too light oil does not result in any loss of power, but it does increase engine wear.

Keep the Engine Clean. Excessive dirt on the engine can result in significant loss of power; lint, mud and oil on the leading edges of the fan, for example, requires additional power to turn it. In water cooled vehicles, the radiator core should be kept free of obstruction so that cooling air passes through easily and keeps the underhood temperatures relatively low. In addition, it is good maintenance practice to keep the engine clean so that malfunctions and deficiencies are easy to see.

Other Wheel Vehicle Tips. Such things as misaligned wheels, and air resistance due to tarps and windshields increase fuel consumption; reduce air resistance if you can. A *cold* vehicle (air temperature 32° F), takes twice as long to warm up as a *warm* vehicle (air temperature 38° F); if possible give the vehicle some protection in cold weather, since excessive warm-up time uses extra fuel.

Driving Practices Which Will Save Fuel

Watch Priming and Choking. Flooding the engine by excessive choking or priming wastes gasoline. Ordinarily, if the choke is pulled out halfway, fuel consumption is increased by two-thirds so do not leave choke pulled out when running; in addition, the excess gasoline runs down into the crank case and dilutes the crank case oil.

Warm Up Vehicle the Proper Length of Time. Racing the engine during a warm-up period uses fuel needlessly, and causes excessive wear to the engine as well. At 50 degrees outside temperature, track vehicles should be warmed up for about five minutes. Tests have shown that more than the minimum warm-up of a wheel vehicle engine is of no advantage—in fact, that warm-up is accomplished more easily during the first few miles of operation than it is at a halt beforehand. (Of course, the engine should be started and the vehicle capable of moving out, even though it may not be completely warmed up.)

Shift Properly. Shift into high gear or into the highest gear range as soon as the engine can pull without *lugging.* Generally speaking, as long as the engine is pulling without *lugging,* it is operating efficiently.

Moderate Acceleration and Deceleration. Try to accelerate and decelerate gradually—maintain constant speed with minimum throttle. Avoid *jackrabbit* starting; floorboarding the accelerator is rarely necessary under normal driving conditions. Fuel would be saved if one were to assume that he had a pie tin filled with water sitting on the floor of the vehicle—then to drive so as to spill as little as possible.

Avoid Lugging *on Slopes and Soft Ground.* When climbing a hill or when terrain is soft and the pulling is hard, shift down to the appropriate gear just before the engine begins to lug. *Lugging* automatically enriches the gasoline mixture, so gas is being wasted if the engine lugs. Whenever possible, take a run at a hill so as to crest it without *lugging,* and so as to maintain a fairly constant speed.

Don't Drive Too Fast. The higher the speed, the greater the fuel consumption. In wheel vehicles, a reduction in speed from 50 to 40 mph decreases fuel consumption about eight percent.

Don't Use Brakes Excessively. Brakes should have to be used little; every time they are used, horsepower is being wasted. In driving track vehicles, excessive steering has the same effect as braking. Incidentally, if track tension is not equal on both sides, excessive steering will be required.

Idle at Proper Speed. An idling wheel vehicle uses gasoline about half as fast as a vehicle traveling at 50 mph. The proper idling speed

for an M48 tank is 650-1000 rpm.

Don't Use Accessories Unnecessarily. Accessories should be used only when necessary. Power requirements are increased as much as 20 percent with the constant frequent use of such accessories as radio, heater, and lights.

Keep Fording Valve Open. On wheel vehicles, the fording valve should be kept open except during a fording operation. A closed fording valve has the same effect as an obstructed muffler or tailpipe.

Keep Magneto Switches on BOTH Position. For track vehicles, magneto switches should stay on BOTH position when engine is running. Both magnetos need to be operating properly to insure complete burning of fuel.

Choose Driving Terrain Carefully. Terrain which does not tax the vehicle should be used as much as possible. When the driver can choose his course, he should drive on road or hard ground if it is tactically feasible.

Crew Practices Which Will Save Fuel

Use Care in Refueling. In refueling, no fuel should be spilled, and the gasoline tank should be filled only to the correct level—in the M48, this is six and one-half inches from the top of the filler tube since room must be left for expansion of the gasoline; any spillage or overflow is not only wasted, but is a fire hazard.

Crew Comfort Not a Prime Consideration. Engines should not be run solely for the warmth and comfort of the crew.

Charge Batteries Properly. The main engine should not be used just to charge batteries; in a stationary position, the tank auxiliary generator should be used to do this. It should seldom be necessary to operate the auxiliary generator and the main engine at the same time.

Keep Tank Clean. Mud and slush on the suspension system, and on the tank generally, add extra weight and drag, and extra horsepower is then required to move the vehicle.

Lubricate Properly. Proper weight lubricants should be used, since those that are too heavy add to the energy required to move the vehicle.

Tow Correctly. Tow as directly as possible so as to get a straight pull. When towing another tank, use two cables to prevent slewing.

Command Policies Which Will Save Fuel

Under many circumstances the commander himself can be the deciding factor as to whether or not fuel is saved. Actually, of course, he has full responsibility to determine that all the foregoing suggestions are implemented, but he can do still other things.

Motor Pool Operation. The motor officer should be motivated toward fuel conservation, and should be alert to the proper adjustments and techniques which will promote gasoline saving. The replacement of defective and wornout components should be encouraged. Thorough maintenance checks should be demanded. The necessary test equipment should be available for the use of motor pool personnel—a vacuum gauge, for example, is essential to make proper adjustment of the carburetor and of the timing system. Mechanics should be trained in the use of such equipment, and be encouraged to use it.

Convoy Practices. The commander has responsibility for convoy operation. Excessive idling time, excessive warm-up time and excessive cool-off time can increase fuel consumption considerably. Principally it is the commander who can reduce this waste. Though tactical considerations will always govern his decision, improvement is possible.

Results of Fuel Saving Practices

A number of fuel conservation tips have been given. The results have been implied. But what, in fact, can we expect to derive from consideration and application of the suggestions listed?

Money will be saved by reducing the cost of automotive operations.

The tactical range of Armor vehicles will be increased.

Less fuel need be carried in supply trains, and the transport made available for other supplies.

Vehicles will last longer—fuel conservation practices are good maintenance practices.

Can It Be Done?

It has been demonstrated that it can be done in a civilian setting; a recent training research study has shown that it can be done in a military setting, too.

Here is the proof of the pudding. In a study conducted by the U. S. Armor Human Research Unit, Fort Knox, two-thirds of the tank drivers and tank commanders in a T/O & E tank battalion (three companies—nine platoons) received an hour of instruction in the fuel economy practices. The six tank platoons given the one hour of instruction on the mechanic, driver and crew member practices just described used, on the average, about six percent less gasoline during a 150-mile tactical march than did the three platoons which had not received this training. This is a significant saving, from both a statistical and a practical standpoint. Had all nine platoons received this training in fuel economy, enough gas would have been saved to run one tank company an additional 25 miles!

Such emphasis in training at both the advanced individual and the unit training levels, will pay off. Your outfit can do it too.

How to Do It

So it is possible to conduct a successful fuel economy program. Here is how to do it.

First, the attitude of the commander and of the men in his command should be positive, an aggressive determination to operate vehicles more efficiently. Without this motivation, any of the suggestions described stand a small chance of being effective.

Second, fuel economy requires training, then constant and vigilant supervision at each level of command. Commanders, crewmen, motor officers and mechanics all must participate. It should not be forgotten that good shop supervision is just as necessary as good field supervision.

Third, once a favorable attitude has been established and proper supervision is being maintained, the whole program can be further stimulated by the commander's active interest in it. Competition between units, making known the results of competition, and giving rewards for good performance—all of these will help maintain the high level of performance which the commander desires.

Armor commanders will recognize in the new organization many elements of the 17T ROCAD with which they are familiar. There was no change in the total aggregate strength of the division although minor strength adjustments were made in all subordinate units.

(U. S. Army)

Revisions to ROCAD

By COLONEL JOHN A. BEALL

Introduction

EARLY in 1957 the Department of the Army directed that the then new Armored Division 17T (ROCAD) be evaluated by field agencies and that changes to increase its combat potential be submitted. This is the normal evaluation procedure that follows any reorganization of major units. The Commanding General, U. S. Continental Army Command was directed to compile and analyze comments and recommendations from field agencies and submit recommended changes to the Department of the Army.

Early determination was made that the overall division personnel strength would not be increased. Changes in any area that required increased personnel strength had to be compensated for by corresponding personnel reductions in other areas. This was a major factor in determining changes to the organization.

The following additional guidelines were followed:

1. The division would have organic only those units and items of equipment habitually used in its normal operation—other items and units to be attached when required.

2. Changes recommended must increase the combat potential of the division as a whole and not necessarily increase the combat potential of any one segment.

3. Efforts were made to determine any *soft* areas in the division from which personnel spaces might be withdrawn in favor of higher priority requirements.

As a result of the Department of the Army directive, all Armored Divisions of the Active Army submitted recommendations based on their experience in garrison and in the field. These were compiled, correlated and analyzed by CONARC with the assistance of The U. S. Army Armor School. In late 1958, CONARC submitted comments and recommendations on ROCAD to Department of the Army. Field experience established that the ROCAD organization had retained the traditional characteristics—flexibility, mobility and firepower—of the former armored division. The division was well suited to carry out its missions under conditions of non-atomic warfare and equally suited for atomic warfare. No major revision in organization structure was indicated; however, adjustments in some areas were required to increase its combat potential.

On 29 December 1958, the Department of the Army approved a plan for the revised organization. Detail TOEs are now in process of preparation and reorganization of armored

---

COLONEL JOHN A. BEALL, JR., Armor, graduated from USMA in 1935. During World War II he served in Europe with the 2d Armored Division. Subsequent assignments included Third Army, Constabulary, OCAFF and D/A. Graduating from the Air War College in 1951 he became the Armor instructor at the Air University. Next he was Chief of Staff, 45th Infantry Division, then Senior Advisor to VI Corps, Korea. Returning Stateside he was G1, later G3, III Corps, Fort Hood. He is Deputy for Armor, Office of the Special Assistant to the Commanding General for Combat Arms, USCONARC.

divisions under the revised structure will follow.

No Major Changes

Armor commanders will recognize in the new organization many elements of the 17T ROCAD with which they are familiar. There was no change in the total aggregate strength of the division although minor strength adjustments were made in all subordinate units. The division has retained the flexible organization of three Combat Command Headquarters to which can be attached divisional combat and combat support units tailored for specific missions. The Division Trains organization has been continued as has the Division Artillery.

Four Armored Infantry Battalions each consisting of a Headquarters and Headquarters Company and four Rifle Companies have been retained. Within the Rifle Company there are still a Company Headquarters, three Rifle Platoons of three Rifle Squads and a Machine Gun Squad each, and a Mortar Platoon of three 81mm mortars. Radio communication within the Rifle Company has been improved by the addition of an AN/PRC-8 radio net.

The four Armor Battalions consist of a Headquarters and Headquarters Company and four Tank Companies as before. Within the Tank Companies there are still a Company Headquarters and three Tank Platoons of five tanks each.

Division Artillery retained the Division Artillery Headquarters and Headquarters Battery, three Battalions of 105mm Howitzers and the General Support Composite Battalion (Self-Propelled) organization. The Composite Battalions consist of a Headquarters and Headquarters Battery, a Service Battery, two Batteries of six 155mm self-propelled Howitzers each, a Battery of four 8" self-propelled Howitzers and a Missile Battery of two 762mm Self-Propelled Rocket Launchers. The requirement for the Division Fire Support Coordination Center has been recognized by the provision of additional personnel and equipment to help man this Center.

The Armored Cavalry Squadron with its Headquarters and Headquarters Troop and four Reconnaissance Troops has not been changed, although the structure within the Troop has been materially changed as will be indicated later.

There have been no major organizational changes in the Signal Battalion with its Headquarters and Headquarters Company, its Command Operations Company and its Forward Communications Company. The latter Company has retained its three area support platoons providing area signal services. The ROCAD area communication system has been continued for further tests.

The Engineer Battalion has retained its Headquarters and Headquarters Company, its four Engineer Companies and Bridge Company. An Armored Vehicle Launched Bridge Platoon has been added to the Bridge Company.

An Aerial Surveillance Platoon has been added to the Aviation Company.

The Quartermaster Battalion has kept its Headquarters and Headquarters Detachment, its Supply Company and Field Service Company. An increase has been made in the Bulk Fuel Transportation capability of the Supply Company.

There were no significant changes in the Medical Battalion which still consists of a Headquarters and Headquarters Detachment, Ambulance Company and Clearing Company.

The Ordnance Battalion has retained its basic structure of a Headquarters and Main Support Company and three Forward Support Companies although the maintenance capabilities of these companies have been augmented.

The Administrative Service Company and the Military Police Company have remained unchanged except for minor reductions in strength.

Significant Changes

As a result of field experience and in line with the guidelines enumerated above, the following significant changes were approved by Department of the Army.

1. Provision for a Division Alternate Command Post.
2. Provision for a Division Fire Support Coordination Center.
3. Reorganization of the platoons of the Reconnaissance Troop into three integrated arms reconnaissance platoons.
4. Addition of an Armored Vehicle Launched Bridge Platoon in the Bridge Company of the Engineer Battalion.
5. Reorganization of the combat surveillance and target acquisition agencies of the Division.
6. Increase in the bulk fuel support capabilities of the Quartermaster Battalion.
7. Addition of a third echelon Aircraft Maintenance Detachment.
8. Addition of an approach control team to the Division Aviation Company.
9. Addition of an avionic repair team[1] to the Division Signal Battalion.
10. Establishment of a Division Radiological Center.
11. Increase in the Armored Ordnance Battalion capability.
12. Elimination of all cooks helpers except those in the Medical Battalion.

Other minor changes recommended from the field will be included in final TOEs now under preparation.

Division Alternate Command Post. An increase of four officers and five enlisted men to the Division General Staff Sections has been provided in Division Headquarters and Headquarters Company. In addition to the increase to the General Staff Sections, nine additional communication personnel have been provided in the Division Signal Battalion. These give the Division the capability of operating a Main and Alternate Command Post simultaneously in the field. The primary purpose of this Alternate Command Post is to assume command in the event the Division Main Command Post is destroyed. In addition, it can cover the displacements of the Main Command Post.

Division Fire Support Coordination Center. An addition of 14 enlisted men has been provided in the Division Artillery Headquarters and Headquarters Battery to support the operation of the Division Fire Support Coordination Center (FSCC). This provides for operation on a 24-hour schedule and further provides the FSCC with a displacement capability.

[1] Aviation Electronic Repair Team.

Reorganization of the Reconnaissance Troops. The only major change in the Division combat elements was in the Reconnaissance Troops of the Division Armored Cavalry Squadron. In ROCAD 17T, the Reconnaissance Troops were integrated at the Troop level—each troop consisting of a Headquarters, two Tank, one Armored Infantry, and one Scout Platoon and a Mortar Section. For some time the Reconnaissance Troops of the Armored Cavalry Regiment and ROCID have consisted of a Troop Headquarters and three integrated arms platoons. These three integrated Reconnaissance Platoons each consisted of a Headquarters, a Scout and a Tank Section, a Rifle and a Support Squad. After careful consideration, it was decided to change the ROCAD Reconnaissance Troop organization so that it would be the same as the Reconnaissance Troops in ROCID and the Armored Cavalry Regiment. This will standardize the organization, equipment and employment of all Reconnaissance Troops. It has been determined that the training of small units and small unit commanders is most effective if their unit organizational structure is the same as that to be used in combat. In addition, this revision resulted in a considerable personnel saving for use in other areas of the division.

Armored Vehicle Launched Bridge (AVLB). The AVLB, which consists of 60-foot bridges capable of being rapidly emplaced from an armored vehicle, fulfills the Division requirement for rapidly bridging small streams. The AVLB has recently been standardized and a platoon of six AVLBs with their launchers and three extra bridges has been added to the Bridge Company of the Division Engineer Battalion.

Reorganization of Combat Surveillance and Target Acquisition Elements. The availability of ground and airborne radars and aerial surveillance equipment provide a means of increased combat surveillance and target acquisition within the division. Short and medium ground radars have been integrated into the combat companies and battalions. Long range ground radar has been integrated at the Division level. Aerial radar, aerial cameras and a surveillance drone system have been incorporated into the Aerial Surveillance Platoon. This platoon has been placed in the Division Aviation Company to provide maintenance and logistical support for its aircraft, although it will operate under the operational control of the Armored Cavalry Squadron Commander. It replaces the Reconnaissance and Surveillance Platoon currently in the Headquarters and Headquarters Troop of the Armored Cavalry Squadron.

POL Bulk Fuel Support Capabilities of the Quartermaster Battalion. Commanders have indicated a requirement to increase the refueling tankers of the Quartermaster Battalion to support the bulk POL distribution concept. (See *Steps in the Right Direction* by Captain Richard E. O'Brien in the January-February 1959 issue of *ARMOR.*) The exact changes to be made as a result of this requirement are still under study.

Addition of a Third Echelon Aircraft Maintenance Support Capability. To provide third echelon aircraft maintenance to the division in line with the similar capabilities being incorporated into other type divisions, a Transportation Corps Aircraft Maintenance Detachment (TOE 55-79) has been added to Division Trains. This detachment replaces the backup support formerly provided by higher echelons. It results in a saving of five personnel assigned to the Division Aviation Company in TOE 17T. The addition of one officer and one enlisted man to Division Headquarters will provide effective supervision of the added Maintenance Detachment and more efficient operation of the Division Transportation Section.

Addition of an Approach Control Team to Division Aviation Company. The addition of this team of seven personnel is required to give a ground control approach at the division airfield to enable aircraft to continue to operate at night and during periods of reduced visibility.

Addition of an Avionic Repair Team.[2] To insure efficient and continuous operation of the large quantity of electronic equipment installed in or used with division aircraft, a team of four enlisted men, consisting of an electronic supervisor and three repairmen, has been added to the Headquarters and Headquarters Company of the Division Signal Battalion. This was essential since no comparable team was available from Corps or Field Army sources.

Establishment of a Division Radiological Center. The advent of atomic weapons indicates the necessity for specialist personnel to predict radiological fallout both in planning operations and in defense against enemy use of nuclear weapons. A Radiological Center, consisting of one officer and four enlisted men, will be a part of Division Staff and will perform the functions of predicting radiological fallout, evaluating fallout reports and disseminating fallout information.

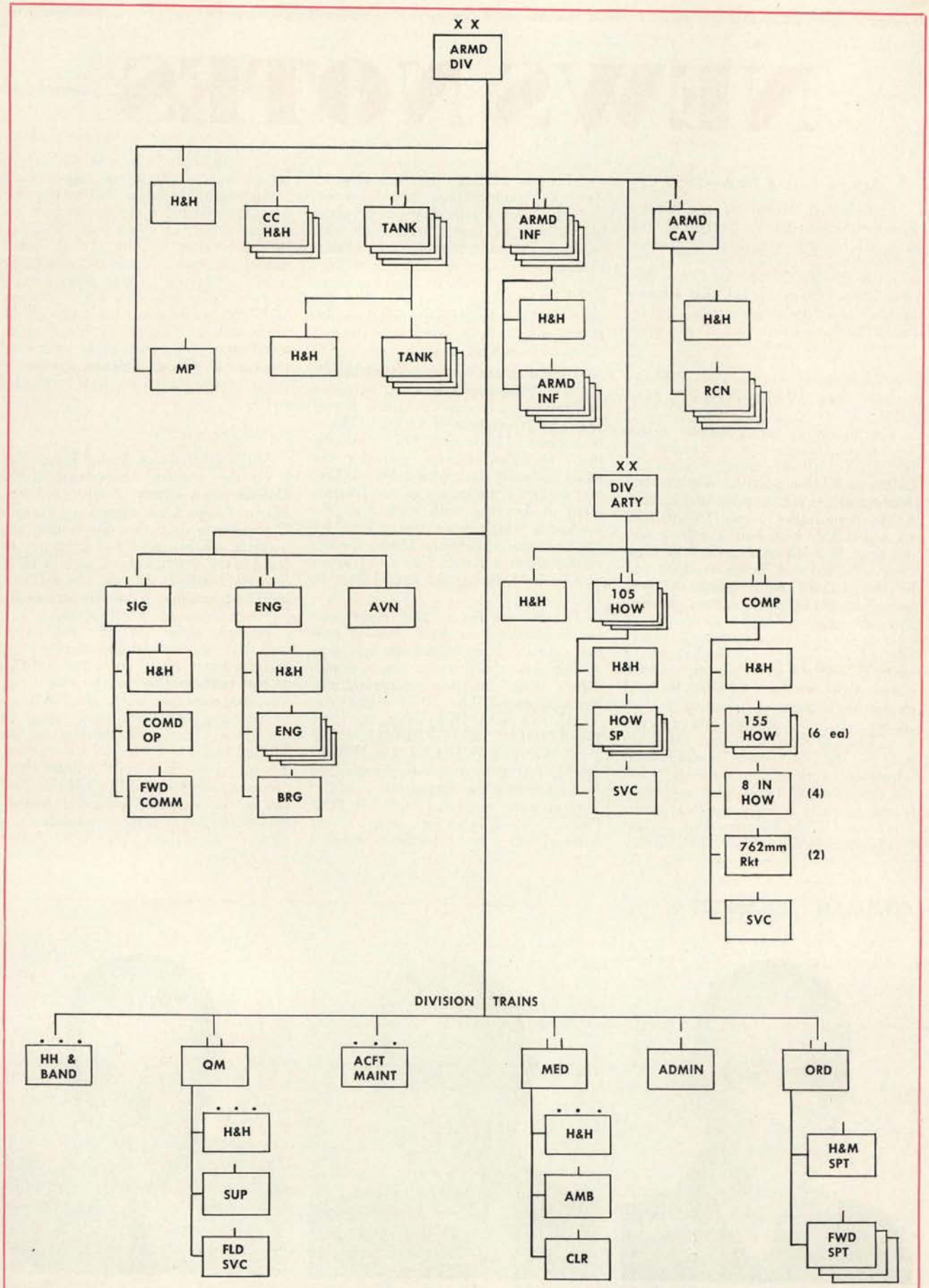
Increase in Armored Ordnance Personnel. Commanders' reports of the 17T Division indicate that an increase in Ordnance personnel would increase overall Division maintenance efficiency. In the Headquarters and Main Support Company specialists to handle parts, requisitions and records, have been added. In each of the Forward Support Companies, Ordnance parts specialists, machinists and a fuel and electrical system repairman have been added.

Deletion of Cooks Helpers. All cooks helpers except in the Medical Battalion have been deleted. Although the requirement for cooks helpers in garrison is recognized, rapid advances in field rations to include irradiated foods and easy to prepare dehydrated rations have released these spaces for other use more directly connected with combat potential. A saving of 96 personnel has been effected by this action.

Summary

As can be seen from this article, although no major change in organizational structure has been made, many minor improvements throughout the Division structure have been accomplished. The fact that only minor revisions were indicated as a result of field experience speaks well not only for the soundness of the organizational structure, but for the competence of the original architects of the ROCAD organization. Many will regret the reduction of 16 light tanks in the Armored Cavalry Squadron by this action, but no one will question the fact that the revised ROCAD Division, to be published as TOE 17D, will be the strongest combined arms division in U. S. Army history.

[2] Aviation Electronic Repair Team.



New Armored Division Organization

NEWS NOTES

Armed Forces Day—1959

The Armed Forces of the United States, throughout the country and overseas, will be hosts to their American and international neighbors May 9-17, 1959, when the Army, Navy, Air Force, Marine Corps, Coast Guard and Reserve Forces throw open their gates to give friends at home and abroad an opportunity to see all aspects of our national strength. The 1959 observance will emphasize the role of our Armed Forces in the Free World POWER FOR PEACE.

The planning and conduct of this annual joint exercise is a valuable experience for all concerned. Within the continental United States, displays and demonstrations will be presented in some 3,000 communities. About 500 parades are scheduled, with half a million participants. In addition, hundreds of exercises, exhibits and demonstrations will be presented for civilian guests at "open house" events in posts, camps, stations, bases and other defense facilities.

Date for this annual observance was selected after lengthy consideration of weather and other important factors. Such an observance could not be held in winter because of weather, nor in summer because schools and colleges would be unable to participate, and any date in the fall would conflict with school and college sports events. Also, the date must not be too near any established national holiday, such as Independence Day or Veterans Day. It was finally concluded that the third Saturday in May, even though it falls within 15 days of Memorial Day, would involve the least conflict with established public events and the least interference with business, industry, education, and other elements of national community life, and would therefore be most likely to receive the greatest public attention. Accordingly, the President proclaimed the third Saturday in May, 1950, as the first Armed Forces Day.

A Presidential Proclamation of March 5, 1957, proclaimed the third Saturday in May of each year as Armed Forces Day. A Department of Defense Directive issued in November 1957, to implement the Proclamation, provides the basic authority for Armed Forces Day and reaffirms the policy of the Department of Defense with respect to observances which have significance for the Services individually. Under the Directive, Armed Forces Day observances will be held during the period May 9-17, 1959.

The Armed Forces Day observance has emphasized the basic concept that our national security and our free way of life depend upon the power which comes from American teamwork and national unity. The 1950 slogan was TEAMED FOR DEFENSE, in 1951 DEFENDERS OF FREEDOM, and in 1952 UNITY—STRENGTH—FREEDOM. The 1953 observance was keyed to the fact that the Armed Forces of the United States represent POWER FOR PEACE—a slogan so appropriate to our national policy that it has been retained for each succeeding year since then.

Although Armed Forces Day is a public event and has been the occasion for a wide variety of community activities, the observance is primarily an "open house" program. Wherever feasible, the public is invited to visit posts, camps, stations, bases, armories, reserve centers, and other facilities in our national defense system. The public is, in effect, given an opportunity to make an annual inspection of the defense system in which every American has a vital interest.

Public Interest

Major emphasis of Armed Forces Day is on the primary components of the Defense team—Army, Navy, Air Force, Marine Corps, Coast Guard and Reserve Components—but the observance also involves organizations and programs related to the defense effort, such as U. S. Savings Bonds, Red Cross, United Service Organizations, Civil Air Patrol, Selective Service and Civil Defense.

Records show that the public has welcomed this annual opportunity to see the defense team in operation and that public participation in the observance has increased annually. In 1953, approximately 500 "open house" programs at Armed Forces installations in the United States and overseas were attended by more than four million men, women, and children. In 1958 the number of "open house" programs had increased to 2,200 with an attendance of almost ten million. The 1958 Armed

COMMAND CHANGES

(U. S. Army)

Lieutenant General Clyde D. Eddleman
C-in-C, USAREUR

(U. S. Army)

Lieutenant General Francis W. Farrell
CG, U. S. Seventh Army

(U. S. Army)

Major General Paul D. Adams
CG, V Corps

(U. S. Army)

General Henry I. Hodes
To Retirement

Forces Day programs had a direct impact upon nearly 22 million people in the United States and abroad. Millions of others learned more about "Power for Peace" through radio, television and other news media.

Army Underground Shelter

An underground shelter designed for protection against atomic weapons effects has been tested with conventional explosives under high explosive blast conditions, the Department of the Army has announced.

The corrugated metal structure is designed for use in overseas theaters of operations.

Tests of a prototype at the Army Engineer Desert Test Station, Yuma, Arizona, indicated that the new shelter can withstand blast pressures up to 60 pounds per square inch (psi). An exterior pressure loading of 30 psi was reduced to four-and-a-half psi inside the shelter.

The primary purpose of the tests was to evaluate the entrance, blast arrestor and ventilation designs.

The manual-powered ventilation system was tested during the Yuma series. Forty volunteers spent 24 hours in the shelter without incident.

The shelter is formed of heavy corrugated steel plates bolted together in the shape of a parabolic arch. The crown height of seven feet affords ample headroom. Some 68 feet long and 10 feet wide, the test unit was placed in an excavation 11 feet deep and covered with four feet of soil. Entrance to the shelter is through two combined vertical and horizontal tubes, each three feet in diameter and 30 feet in overall length, capped with a perforated blast cover and door. At ground surface, rocks are placed around the tubes to a depth of five feet to form a blast arrestor. The blast arrestor is patterned after a Swedish design.

The air supply is drawn from the atmosphere through the perforated blast cover and rock bed into the entrance tubes through a number of small holes in the sides of the tubes. Hand-operated blowers are used to draw fresh air into the shelter and to force out vitiated air.

The design of the new blast resistant shelter was engineered by the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia. The design concept was developed by the Planning Studies Division, Army Map Service.

Army Awards Contract for Hawk Missile System

A $50,731,000 contract has been awarded to Raytheon Manufacturing Company of Waltham, Massachusetts, for production of the Hawk Missile System, the Department of the Army has announced.

A total of $33,296,000 is for production of ground equipment and $17,435,000 is for production of the Hawk missile.

Work on the contract will be done at the Raytheon plant at Andover, Massachusetts.

Hawk is the Army's killer missile designed specifically for use against low altitude targets. Hawk has successfully engaged targets from treetop level to 38,000 feet. In a recent test the Hawk missile scored a direct hit on a 1400-mile-an-hour XQ5 target missile.

The Hawk is about 16 feet long and 14 inches in diameter and uses a solid-fuel propellant.

The Hawk system uses several types of lethal, modern warheads. Raytheon is prime contractor under Army Ord-

(U. S. Army)

Brigadier General Frank S. Henry
Chief, Armor Branch, CMD

(U. S. Army)

Major General John L. Ryan, Jr.
Headquarters USARPAC

(U. S. Army)

Major General W. Paul Johnson
CG, U. S. Army Armor Center

(U. S. Army)

Major General Ralph J. Butchers
CG, U. S. Army Trng Cntr, Armor

nance for development and production of the entire weapon system.

It can be operated both in the continental U. S. air defense complex at fixed installations and with fast moving combat troops of the field Army. Hawk, in its mobile role, will be used by the U. S. Marine Corps as well as by Army missilemen.

Breakthrough in Design of New Radio Tube

Development of a new, cool-running radio tube, considered the first major breakthrough in basic tube design in more than 30 years, was announced recently by the Department of the Army.

The radically new tube, developed jointly by the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey, and Tung-Sol Electric Incorporated, Bloomfield, New Jersey, glows blue instead of red and uses less than one-tenth the power of a standard hot cathode tube.

The new "cold cathode" tube could be the forerunner of a new line of general-purpose tubes for broad military and civilian use. Due to its potential reliability, the tube may outlast any equipment in which it is used. In the future, radios and TV sets equipped with cold tubes may rarely, if ever, need tube replacement.

The new tube, like other electron tubes, is extremely resistant to heat and atomic radiation, important in military equipment which must withstand exposure to a nuclear blast or the searing heat of a missile nose-cone.

The cold cathode principle is believed adaptable to almost all types of electron tubes, including TV screens, giant radar and transmitting tubes, as well as nearly all general-purpose radio tubes. Miniature and sub-miniature tubes, which would compare favorably with the transistor in size, may also be feasible.

Ordinary tubes, ever since their invention, have required a red hot cathode element to generate needed electrons. This heating takes a large percent of the power and forces the use of more complicated circuits or extra batteries. In the new tube, the hot element is replaced by a cold cathode—a tiny nickel cylinder specially coated with porous magnesium oxide (chemically identical to dried milk of magnesia). Instead of heat, a high voltage field causes the electron flow, which in turn produces the tube's characteristic phosphorescent blue glow.

The first model of the new tube, built by Tung-Sol under an Army Signal Corps contract, springs to life as soon as it is turned on, while an ordinary tube requires several seconds for warm-up.

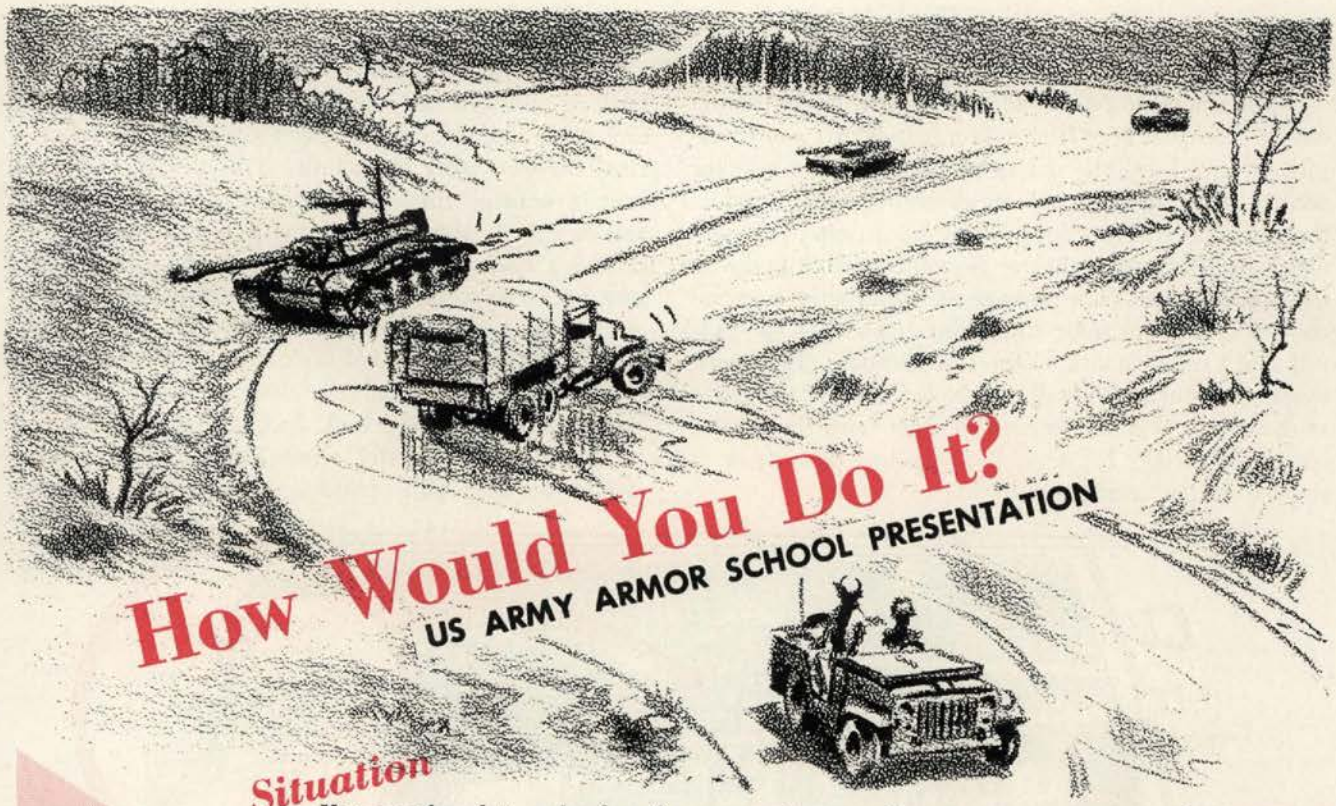
Discovery of the new device may eventually lead to development of smaller, faster-acting walkie-talkies, and simplified design of other communications gear where the heat generated by conventional tubes poses serious problems.

(U. S. Army)

A 175mm gun, 155mm gun, 8 inch howitzer or a standard wrecker can be permanently mounted on this new U. S. Army developed light weight carriage which provides increased range and cross-country mobility. It is expected not only to realize a savings in money but also in the stocking of many of the spare parts.

(U. S. Army)

A new remote controlled drone designated the SD3 was recently successfully tested. It is designed to observe enemy battlefield activities. Weighing less than half a ton and only 15 feet long, with a wing span of 11 feet, it is packed with electronic and advanced sensory devices for guidance control and observation of enemy troop movements, fortifications and battlefield installations. Interchangeable nose units enable rapid switches from one surveillance technique such as photography, infra-red, radar or television, to a different type, depending on mission requirements. In a typical mission the drone is launched from a mobile trailer by two rocket motors. Once in the air the reciprocating engine takes over. Landing is accomplished by an automatic parachute device which floats the drone back to earth. Special inflatable rubber mats, contained within the drone, cushion the fall. Operational capabilities are at varying altitudes although most missions are accomplished at low level where the drone's tiny size and speed aid in dodging enemy radar and guns.



How Would You Do It?

US ARMY ARMOR SCHOOL PRESENTATION

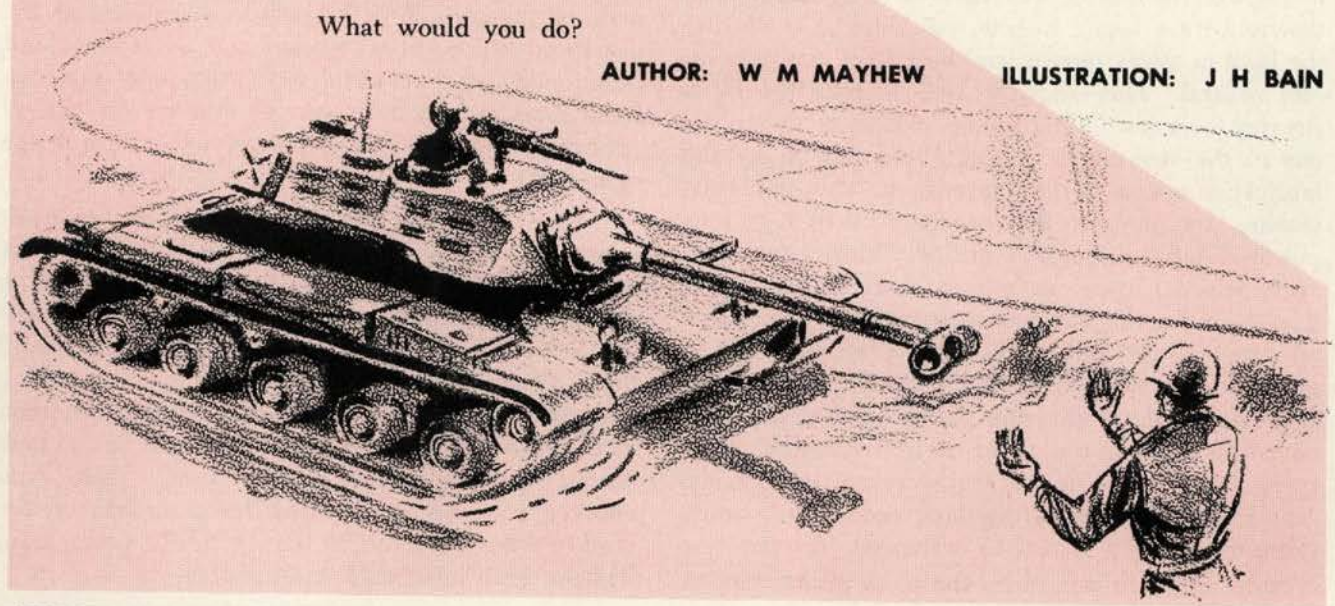
Situation

You are the platoon leader of a reconnaissance platoon participating in a field training exercise. Last night the weather turned extremely cold and a heavy sleet fell, covering the roads and ground with a slick, glare ice. This morning, as your platoon is marching to a new assembly area, the driver of one of the M41 light-gun tanks drives into the ditch along the right side of the road to avoid hitting a truck skidding toward him from the opposite direction. You stop the platoon column and return to the tank in the ditch.

After considering the situation, both you and the tank driver decide that the tank should be able to pull out of the ditch, back onto the road. The driver gets in the tank, places the transmission in low range, and starts the vehicle moving forward. Just before he begins to steer to the left to bring the tank back on the road, the track on the right side loses its traction and starts to spin. The driver, after several further attempts to move the vehicle, reports to you that he is unable to get either track to move in any of the transmission ranges *except in neutral steer*. You tell the driver to leave the engine idling and to help you check the trouble.

What would you do?

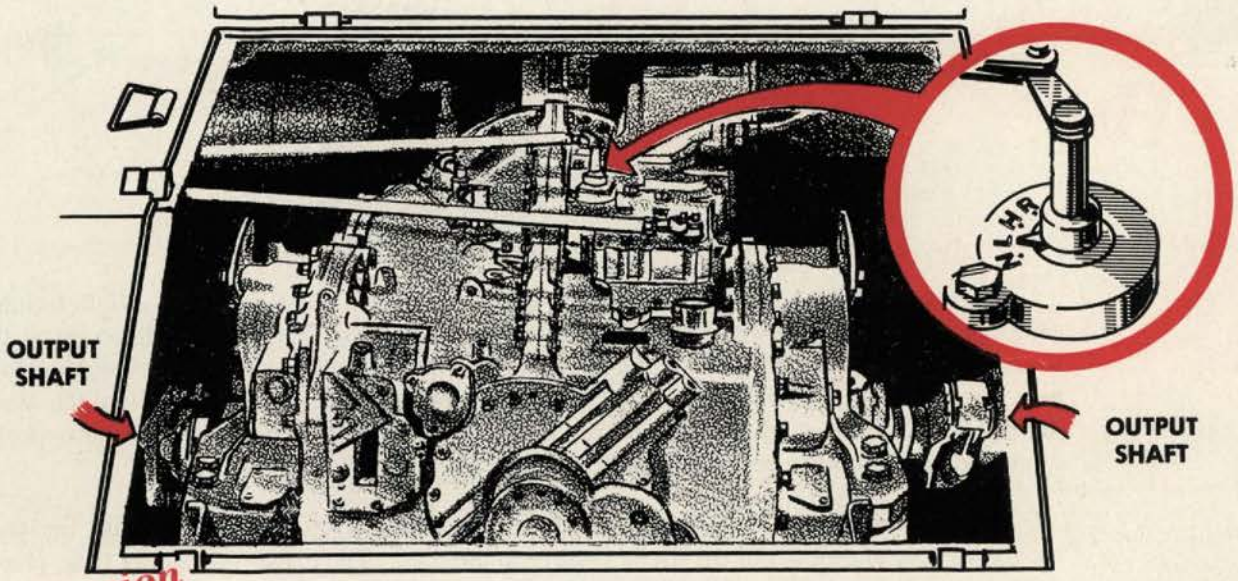
AUTHOR: W M MAYHEW **ILLUSTRATION: J H BAIN**



Solution

You open the two large doors in the center of the engine compartment that give access to the transmission and have the driver move the range selector control lever through all of its shift positions while the engine is still running. While he is doing this, you check the linkage at the range control valve body on the transmission. The linkage is apparently in good condition. At the same time, you also check the output shafts on each side of the transmission. The transmission output shafts will not move in any of the drive ranges *but will move in neutral steer* with the engine running at 1000 RPM, so you decide that there is trouble in the transmission.

You recall that the CD-500 transmission has a built-in safety device which shifts the unit into neutral any time the tracks overspeed or break or when a final drive or steer shaft fails. This device keeps the unit in neutral until the engine is stopped. You tell the driver to shut off the main engine, meanwhile ordering one of the other tanks in the platoon into position so as to be able to tow the disabled tank. At your command, the drivers of both vehicles start the engines, and the disabled tank is assisted back on the road. After the tow cable is disconnected, you check with the driver of the tank and find that the vehicle is functioning normally again, as you suspected it would be, and your platoon continues on its way.



Discussion

Your examination of the transmission showed that the output shafts were not rotating *except in neutral steer*. This fact demonstrated that some kind of trouble existed at least in the transmission. Remembering that the trouble was reported immediately after the right track began to spin, you think it likely that the built-in safety device has shifted the transmission into neutral. This safety feature is activated by a steering overspeed limit pump, which is driven by one of the steering cross shafts and fed oil by the lubrication system in the transmission. During normal steering, the pump merely circulates oil from its output to its input through an orifice. When a condition exists which causes one output shaft to turn faster than the other, the pump pressure increases, the orifice restricts the flow, and pressure builds up in the line in proportion to the difference in speeds between the steer shafts. If the pressure builds up to a predetermined limit, the pump closes the spring-loaded, overspeed safety valve in the range control valve body. This happens whenever anything occurs that would cause the steering system to overspeed. (In this case overspeeding was caused by the track losing traction and spinning.) The critical oil pressure is exceeded and the overspeed safety valve closes. When the valve closes, main pressure to the range control valve is shut off, and the transmission is put into neutral. The main oil pressure is diverted to hold the overspeed valve in the closed position until the engine is shut off and main oil pressure drops below spring pressure on the overspeed valve, even though the overspeed limit pump may have returned to normal operation. In some cases it may take several minutes for the oil pressure to drop and allow the valve to return to the open position.

Your reasoning that the spinning of the track caused the overspeed safety valve to close was correct and led you to the correct solution. First, you told the driver to shut off the main engine and allowed time for the pressure to bleed down so that the valve would open. Second, you procured another tank for towing and avoided repetition of the overspeeding condition in the steering system and possible abuse of the tank during movement back on the road. Third, you checked with the driver after the tank was on the road to ensure that further damage in the power train had not been incurred.

FROM THESE PAGES

65 Years Ago

The best opportunities for a cavalry attack upon the enemy's cavalry are when the latter is issuing from a defile and presents a narrow front; when it can be surprised in a column formation; when it can be taken in flank while charging another body; when it is exhausted; while it is changing formation, or when it is on ground unfavorable to its deployment. In the latter case, the ground, while unfavorable to the deployment of the enemy, must, of course, offer no obstacle to that of the attacking cavalry—for instance, the enemy may be emerging from a wood into an open plain on which the attacking cavalry can readily deploy, while the enemy's deployment is still obstructed by the wood.

It is evident that the combats of cavalry with cavalry will generally be fought between the cavalry divisions. The divisional cavalry will habitually be used in conjunction with the other troops of the division, and will rarely be engaged in a pure cavalry fight, except when united with the cavalry divisions in screening duty, in the pursuit, or in covering the retreat, or when employed in defending the divisional artillery from an attack by the enemy's cavalry.

CAPTAIN ARTHUR L. WAGNER

Cavalry in Attack and Defense

50 Years Ago

Before venturing to approach the portion of the subject of which this article treats relating to equipment and arms, it would be well to endeavor to clearly appreciate the role which the machine gun attached to cavalry is designed to fill and toward which equipment and arms are but as means to an end.

The value of the mounted troops in war depends on the increased mobility they possess in virtue of being mounted. And by mobility we mean not merely speed, but capacity to cover long distances at relatively high speed while still having something in hand at the end of the march for fighting or any other eventuality; and, like the proverbial weak link in the chain, the least mobile component of a cavalry command measures the mobility of the unit.

The machine gun with the cavalry should be a substitute for rifle fire rather than a supplement to it.

Movements in advance, to a flank, pursuits, rear guard actions, to check a turning column, to secure and hold positions until the arrival of the infantry, to move rapidly to other positions, allowing the cavalry to be more than ever, cavalry pure and simple, is a role which, for its accomplishment, makes it requisite that the machine gun organization attached to cavalry be equipped with guns, saddles, etc., the weights of which, and the manner of carrying the loads be such as to not hinder or impede the movements of the cavalry command.

FIRST LIEUTENANT ALBERT E. PHILLIPS

Machine Gun Organization, Equipment and Arms

25 Years Ago

In these days of too frequent changes of commanding officers, policies, like parliamentary governments, are often short lived—ever changing. For this reason, among others, it is important that policies be carefully thought out, made of official record, widely distributed, prominently posted, and stressed as the daily guide of the command. If well digested and logical, they may be made sufficiently comprehensive definitely to guide the members of the command in their general daily activities, and, if readable, will be eagerly sought by them for study as an aid in personal development of command qualifications. Furthermore, a new commanding officer, finding them in official form, will probably continue them, changing perhaps certain items and adding others to conform to his own concepts of military management but, what is important for the command, perpetuating them in recorded form. This is to the decided advantage of all concerned, for it is always conducive to both cooperation and morale to know positively just where the commanding officer stands and just what he expects.

COLONEL J. C. JOHNSON

Policies

10 Years Ago

All of our discussion so far seems to point up the armored infantry accompanying or following the tanks, to engage in dismounted, close-in combat when needed. One might be led to ask, "Does not the armored infantry play the leading role, supported by the tanks, in some situations?" The answer is, of course, that it does. Whenever the terrain or the objective is such that the armored infantry can, by dismounted action, better carry the fight to the enemy, then it is so used. Such situations occur when woods or close terrain render the cannon on the tank virtually useless and at the same time make the tank vulnerable to close-in antitank measures. Likewise, in towns or built-up areas, fields of fire for the tanks are limited, and they again become vulnerable to short-range antitank weapons. Whenever streams, mine fields, or similar obstacles deny mobility to the tanks, the armored infantry is employed in the leading role until the obstacle can be breached and mobility restored to the tanks. In all these predominantly armored infantry missions, tanks are employed in the supporting role. They provide direct fire support and furnish antitank and other protection to the front, flanks, and rear. Thus we see how the terrain and the organization of enemy resistance become determining factors for the combat commander in organizing his reinforced battlations and in assigning them missions.

LIEUTENANT COLONEL MORGAN G. ROSEBOROUGH

"Tin Can Doughboys"

THE BOOK SECTION

After weeks on end of bitter experience and learning the hard way, American Armor began to come of age and win battles. More and more often it became the practice to concentrate a greater number of tanks and employ them as a supported divisional striking force.

ARMOR COMMAND. By Brigadier General Paul M. Robinett, Ret. 252 pp. McGregor & Werner, Inc., Washington, D. C. $3.95.

Reviewed by Brigadier Sidney R. Hinds, Ret.

THE book *Armor Command* is a forthright and splendidly written account of the final seven months of the North African campaign of World War II leading up to the defeat of The Desert Fox Rommel, and the end of the famed Afrika Korps. It takes the U. S. troops from the invasion of North Africa to the completion of the campaign.

The carefully kept notes of the commander of Combat Command B, 1st Armored Division say "This is the way I saw it." They leave few words unminced nor feelings spared in recounting in considerable detail the difficulties of initiation into a war for which, again, we were really unprepared. With respect to equipment undergoing its first battle test, the way of operation of the "High Command," the constant harassment by the Luftwaffe and the lack of coordination between the air and ground elements of our battle team, they also speak freely. On the other hand, General Robinett is unstinting in his praise of the soldiers and officers who performed with magnificent courage against a battle-wise enemy and the ever-present elements of mud, cold and bleakness of the Tunisian desert.

Even with all the grotesqueness of war the writer could see artistic beauty in "The moon was shining brightly between patches of fleecy clouds racing across the sky as a long column of British night bombers droned overhead on their way to Kasserine Pass and the roads beyond. The distant thunder of their bombs made sweet music in our ears—." Certainly there is no sweeter music to battle-grimed soldiers nor a greater boost to their morale than the roar and tremor of well placed bombs—when they are friendly bombs.

As a realistic portrayal of battle

(Continued on page 60)

THE AUTHOR

Brigadier General Paul M. Robinett, Retired, noted historian, author and frequent contributor to these pages, served in the 1st Armored Division during the North African Invasion commanding a Combat Command until he was wounded six months later. Returning Stateside, he was assigned as Commandant of the Armored School. Medically retired in 1946 he worked in the Office of the Chief of Military History, D/A until the Fall of 1957. He is the author of the book *Preparation for Leadership in America.*

THE REVIEWER

Brigadier General Sidney R. Hinds, Retired, a 1920 USMA graduate and Olympic participant in pistol and rifle marksmanship, served in Europe during World War II with the 2d Armored Division commanding a Combat Command. Subsequently he commanded the ARTC at Fort Knox. Medically retired in 1947 he worked with the International Refugee Organization, and the United Nations. He is now engaged in conducting a study for the Department of State to increase the utilization of free world manpower.

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

Benjamin Franklin

This book is designed to educate the leader to function better on the nuclear battleground. Its objective is to simplify the data available to the military nuclear specialist. It embraces both tactics and technique—illustrated with clarity and simplicity.

NUCLEAR TACTICS, Weapons, and Firepower in the PENTOMIC Division, Battle Group, and Company. By Colonel T. C. Mataxis and Lieutenant Colonel S. L. Goldberg. 254 pp. Military Service Publishing Co., Harrisburg, Pa., $3.50

Reviewed by
Lieutenant Colonel Robert B. Rigg

WHETHER in past or future warfare, the true nature of combat is difficult to index by the tactics involved. Even when studying military history it is easy to obtain a disproportionate view of war by concentrating solely on the tactics and geometry of battles. In contemplating a future nuclear war, the difficulty is even more magnified, because no one has experienced even a fraction of its megaton horror.

Nuclear Tactics is an excellent text that is mainly concerned with the geometry of nuclear combat. As with any book of this order, its preface was written long ago by Stephen Vincent Benet whose classic lines reveal the opposite side of the tactical coin:

(Continued on page 62)

THE AUTHORS

Colonel Theodore C. Mataxis, Infantry, received his BA degree from the University of Washington in 1940. He commanded an Infantry battalion in Europe during World War II and a regiment in Korea. Subsequent to the War he supervised the writings of captured German Generals on operations in Russia. Graduate of the Army War and Indian Joint Defense Services Staff Colleges, he has been a specialist in nuclear weapons and tests. He is presently with the 8th Infantry Division, Seventh Army in Germany.

Lieutenant Colonel Seymour L. Goldberg, Infantry, received his education in the District of Columbia and is a member of the D. C. bar. Receiving his commission from OCS in 1942, he served in Europe during World War II as an Infantry Battalion Executive Officer. A 1952 C&GSC graduate, he went to Korea to G3 Section, X Corps, then commanded a battalion. Returning Stateside he was assigned to Benning where he became skilled in atomic weapons. He is with DCS/OPS, Department of the Army.

THE REVIEWER

Lieutenant Colonel Robert B. Rigg, Armor, noted author on Red China, training and futuristic warfare, served as a military observer with five different allied armies, including the Soviets, during World War II. Next he observed the Civil War in China for more than two years. After a D/A Intelligence assignment, he went to the Constabulary. Returning Stateside, he again served on the Army General Staff. He is presently with the Combat Developments Group at The U. S. Army Armor School, Fort Knox.

in an Armor outfit the author relates actual experiences and personal reactions that run the gamut of human emotions. The human element is probably the most important factor in the day-to-day life of a commander in constant contact with the enemy 24 hours a day, for weeks on end as was the case in the North African campaign. There is no substitute for such experiences. The brain-racking tactical problems at Leavenworth and the high-level strategic committees at the War College do not, and cannot, teach battle experience. There simply is no comparable "pressure" that can say, "This is a battle, you are dead-tired, muddy and half-frozen, you and your command may be mauled by the enemy within the next few hours, the 'old man' doesn't like the way the battle is going and may, in a breath, justly or unjustly, relieve you and send you 'back'." These experiences are shared by General Robinett with his readers and this fact, if no other, amply justifies his publishers in providing to future leaders this strongly etched picture of a tactical combat command commander with the greatest personal responsibility known to man—command of men in battle.

The criticism of the tanks with which the Army was equipped to fight the early stages of the war in Africa and Europe were not entirely unjustified. The M3 tank was a direct descendant of the post-World War I Ordnance designed tanks which were described by the Infantry tankers of those days as, "A wonderful vehicle—will go 40 miles an hour, but the driver cannot drive and the gunner cannot shoot." At that time Walter Christie was spending a million dollars of his own money to make a tank to be rejected by the Ordnance Corps and later to be bought by the Russians!

The German high velocity guns would penetrate more armor than would the American tank cannons and, of even greater direct importance, they would penetrate more armor than was carried on either the M3 or M4 tank. Due to the design and thickness of the front armor plate of the German tank our guns would not penetrate at that point. Obviously, in a one-tank vs. one-tank head-on shooting match there was no mathematical doubt as to which would emerge the winner.

The comments concerning the gasoline-powered tanks as compared to the diesel-engined panzers can be fully appreciated only by those who have lived through a burning tank or have seen their buddies in a nearby tank go up in smoke without a chance of "bailing out."

This is not to say that the American tanks were *no good* for they were in many respects superior to even the great German Tiger tanks which had begun to appear on the battlefield as early as the Tunisian campaign. Automotive-wise, that is with respect to the reliability of the engines, power transmission trains and tracks left little to be desired; although the tracks should have been somewhat wider for better flotation in soft or muddy ground. The ability of our tanks to make long, fast and gruelling marches and still be able to fight was a tribute to the American automotive industry and to Ordnance personnel for their part of the designing. This superiority, along with the ruggedness of the tankers, was the basic reason for the legendary glory of "Patton's American Armor" —the term usually applied by the press back in the States to any tank action whether it was in his command or not. The historic march and battle by the 1st Armored Division through the Tine Valley Mousetrap to Mateur and the final encirclement of the remnants of Rommel's tanks was the first of such maneuvers in combat and was possible only because of the built-in stamina of the vehicles. It has probably been forgotten long since that Patton startled the whole Army in the Louisiana maneuvers of 1941 by making a 24-hour 400 mile Armor march to encircle Shreveport and capture the entire "Red" force. During the critique, it was branded as "unrealistic" and "could never happen in war!" No?

In mentioning the pros and cons of World War II tanks it should be pointed out that the side and rear exteriors, and tracks of the German tanks were at least as vulnerable as the corresponding soft spots of the M3s and M4s. Well placed hits, even with inferior guns, would knock pieces of panzers all around the immediate vicinity. However, very few of them burned on the battlefield.

As mentioned by the author, another reason for the Americans being able to field a greater number of tanks than the enemy was the tremendous job turned in by the maintenance battalions. The maintenance crews would snatch a tank casualty off the field and start repairing it just about as quickly as the medical corps aid men would attend the soldiers who had gotten hit. This is a well deserved tribute to both the Ordnance and Medical Corps.

The result of having a superiority in numbers of tanks is obvious; two tanks can always outmaneuver one. Perhaps critics can say that the German tank was superior to the American tank, but history will record that the American tanks defeated the German tanks. So, after all, we should not have to "eat crow" to any appreciable extent in second generation armor post-mortems.

General Robinett's criticism of the strategy and troop disposition and employment of the tanks during the early phases of the campaign, according to accepted theory of fighting armor, seem to be pretty well justified. In the latter part of the campaign, when the 1st Armored Division was concentrated and held in reserve to be unleashed at the opportune time on terrain over which it could maneuver, success came in a matter of days.

The power of Armor is in its mass and its ability to move to exploit the shock of the Artillery and Air strikes. A single tank operating alone or as a part of a small detachment is not much better than a single anti-tank gun hidden away waiting the opportunity to "let him have it." As a regular practice, until about the middle of February 1943, over half of the 1st Armored Division was broken up into small and usually not mutually supporting detachments under local commanders, according to General Robinett's account. However, his command, CCB, was kept at least in the same general area and was available for limited armor action. The chain of command under which CCB operated is not always clear but it appears that for

the most part it was directly under the American II Corps or the British or the French with the 1st Armored Division commander relegated to the sidelines with only a handful of troops at his immedate disposal.

An explanation of these tank dispositions and employment of which General Robinett is critical may be found in the overall picture of the North African campaign from the November 8th landing to about the middle of February; however, it is not likely that such explanation would be acceptable as a School solution by one steeped in Armor tactics. The problem was a very difficult one and perhaps there was no really good solution.

It will be remembered that immediately after the landing at Oran and Algiers a bold overland thrust of 560 miles was made in the attempt to capture Tunis, thus bringing a quick end to Nehring's army and depriving Rommel of the use of that port. This blitz attack failed within sight of the objective, Tunis having been reinforced by Luftwaffe-borne troops before the airfield could be seized. With the record rains which then set in, the invading American army, along with the British and French, were halted in the mud and well overextended. It was a serious situation and demanded that they hang on as best they could while building up supplies and troops to resume the offensive. The front of more than 250 miles extended from the Sedjenane Valley near the Mediterranean to the Sahara on the south with the British, French and American Corps each having approximately the same sectors to hold with one infantry division and about half an armored division. All were relatively inexperienced in battle.

After the attempt to capture Tunis and with the forces still overextended CCB found itself engaged in many difficult situations. The action at Ousseltia is especially vividly recounted. General Robinett's description of the confusion caused by the overlapping of zones of two different Corps and the mixing of tactical units along with delayed and conflicting messages from both the French and II Corps, offers a lesson in battle control and coordination that should sink home to the professional reader. General Robinett gives great credit to the French XIX Corps commander, General Koeltz, for his splendid personal leadership which turned a possible debacle into a successful action on January 25-26 in a little-heard-of but important spot in the bleakness of that winter in Tunisia.

After weeks on end of bitter experience and learning *the hard way,* American Armor began to *come of age* and win battles. More and more often it became the practice to concentrate a greater number of tanks and employ them as a supported divisional striking force. These lessons, together with additional troops in the theater, increase in Air strength, more supplies and the arrival of new M4 tanks, heralded better days to come. Perhaps not the least important, although not the entire salvation as the writer says, were the arrival of new and fresh commanders along with substantial numbers of trained armor replacements drawn from the 2d Armored Division in Morocco. All of these things marked the turning of the tide in the Armor battles to follow the German "high water mark" at Kasserine on the 21st of February in 1943.

The "Poor Bastard" farewell muttered by the 1st Armored Division commander, General Harmon, to General Robinett as he was being evacuated wounded on the eve of the beginning of the final drive against the remaining and near-defeated Afrika Korps was, in a way, a very appropriate expression. Having endured the difficult months of comparative disorganization, overextension and widely separated defensive dispositions of the division along with the mud, cold and general hellishness, it was indeed a bad piece of luck that forced the author out of the sweet and final round. From here on out with a practically unopposed tank mass movement through the Tine Valley (the dominating high ground having been taken by the Infantry), north of Mateur and to the encirclement of Ferryville, Lake Bizerte and the last of the pride of the German army in Africa it was a different story. With good weather, suitable tank terrain, new tanks, armor troops fighting as an armored division and, most important, the scent of victory in the air, it was a pity that the rewards of triumph in battle could not have been shared by the commander of CCB and the other brave soldiers who had fallen wounded or killed in action in Tunisia.

Some comment should be made by the reviewer concerning the author's somewhat salty accounts of conversations and impressions of many of the high commanders in the North African theater. With a sort of "open season" declared on old friends and associates by the distinguished authors of two recent outstanding postwar memoirs [1] in the interest of editorial sincerity this chore is made somewhat easier.

The reader should keep in mind that war is awfully rough at times and it engenders a rough exterior as well as demanding a rugged interior. Men and commanders alike often use the most unspeakable language and profanity imaginable, which they themselves may not even realize, under the pressure of the time and, in any case, have long since forgotten.

"Old Blood and Guts" was not given that nickname for nothing. It was well emphasized in his initial appearances as II Corps commander by his verbal expressions as well as his examples of personal courage and conduct. These actions were for a purpose, namely, to rejuvenate the battle-weary and jaded Corps and bring it to a fighting pitch. In that effort it is entirely possible that a good many men of sensitive or artistic natures were thoroughly offended while others grew to fear him more than the enemy himself; however, with the great majority of soldiers the "performances" were quite effective. Only a Patton could carry off such displays and the author properly points out that good combat troop leading does not necessarily require that type of explosive.

The impressions made by other commanders, most of whom rose to heights of greatness later, are well drawn and, rightly or wrongly, constitute a substantial interwoven part of the fabric of this down-to-earth account of the war, as it looked to the author at the time.

[1] *The Memoirs of Field Marshal Montgomery* and *Wedemeyer Reports.*

If you take a flat map

And move wooden blocks upon it strategically,

The thing looks well, the blocks behave as they should.

The science of war is moving live men like blocks.

And getting the blocks into place at a fixed moment.

But it takes time to mold your men into blocks

And flat maps turn into country where creeks and gullies

Hamper your wooden squares. They stick in the brush,

They are tired and rest

And you cannot lift them up in your hand and move them

—A string of blocks curling smoothly around the left of another string of blocks and crunching it up—

It is all so clear in the maps, so clear in the mind,

But the orders are slow, the men in the blocks are slow

To move, when they start they take too long on the way—

The General loses his stars and the block-men die

In unstrategic defiance of martial law

Because still used to just being men, not block-parts.[1]

Regardless of the quality of the tactics and war plan, men will execute the orders—execute them well or poorly, in accordance with the quality of their leadership. As General Trudeau states in the foreword: "To locate, to train, to utilize commanders at all levels who can function under atomic attack—these are the root of the successful employment of any tactical doctrine." *Nuclear Tactics* is a book designed to educate the leader to *function* better on the nuclear battleground. Its major objective is to simplify the rather obscure and complicated data available to the military nuclear specialist. It achieves this end, acquainting the reader with the hard, nuclear combat facts of life. It embraces both tactics and technique and is illustrated with clarity, simplicity and directness.

The authors successfully tackle a wide range of subjects beginning with nuclear weapons effects and ranging through pentomic firepower, delivery means, target analysis, troop safety, atomic fire support plans, unit protection, and defensive as well as offensive tactics on the nuclear battleground. They emphasize the tactics and techniques all leaders must know. Their text plots combat situations and solutions with very readable clarity. One does wonder, however, why night operations received such brief coverage and emphasis, especially considering their future importance—as well as dangers—dangers wherein entire troop units could be blinded by sudden enemy nuclear strikes. Consider for a moment moving troops, tanks and infantry attacking at night. Suddenly they are exposed to one or more nuclear air bursts the fireballs of which sear their eyes into temporary flash blindness. Serious problems of control would immediately arise amid the confusion of blinded men seeking seeing-eye survivors, and the enemy troops, forewarned as to the moments of flash, could turn from defenders to attackers, striking at the blinded and reversing the entire military situation. In several places the text might have contained a little more flesh and blood realism so as to better acquaint the reader with leadership and casualty problems that will parallel the tactical ones. Little emphasis is given to the twilight casualties—the troops alive but doomed to die because of earlier exposure to radiation. Would they be used in the next attack or sent to rest areas? However, the authors do emphasize the future importance of "maintaining of adequate records in a swift moving battle of the individual or even unit levels of radiation."

Dispersion is an oft used word these days. As a military technique it represents a serious problem in terms of combat application. But the authors tackle the topic definitely and exercise skill in presenting the facets and problems inherent in this technique. For example, they reveal how a commander can check out his unit to see if he has dangerously concentrated it.

One of the debatable points in relation to nuclear combat is the influence of terrain. A modernist school holds that terrain will have little influence and that we will no longer struggle for terrain objectives. Colonels Mataxis and Goldberg take issue with this and score some definitive points such as these:

> The availability of organic nuclear fire support to the division requires a re-evaluation of the classic relationship of terrain to weapons systems, tactics, organization, and objectives. Terrain continues to be important, but in a different aspect. In the past a commander's plan was often directed toward the seizure and retention of critical terrain features which would give him a decisive advantage by providing observation, cover, and concealment. Today with Army aviation providing observation for atomic artillery and missile firepower to blast located targets, positions such as Little Round Top at the Battle of Gettysburg or Pork Chop Hill in Korea, are no longer as important to the overall battle as they were in the past. This is not to say that terrain is no longer a factor to be considered. Vital areas, both strategical and tactical, must still be fought for and held. These areas will be fought for, by creating favorable opportunities for emplacement of tactical atomic weapons to destroy the enemy and denying similar advantages to the enemy. Depending on their level, subordinate units will generally be given somewhat different missions to accomplish this destruction of the enemy. For the division and lower units the mission generally will be translated into terms of seizing one or more terrain features which

[1] From *John Brown's Body* by Stephen Vincent Benet.

will give the friendly forces an advantage over the enemy. The idea will be to seize the terrain features needed so you can keep the enemy from moving, working, operating, firing his weapons, or what have you. It is only by offensive action that you can keep the enemy off balance.

In dealing with "hugging tactics" the authors cite the 13th century use of *bellifugi*—people seized by the Mongols who marched these prisoners before them in the attack. But a point is omitted here—the authors might have elaborated on this topic and mentioned the future problem of refugees cluttering the battleground or even used by a Communist enemy as *bellifugi*. People were used as such in Korea.

Individual readers may take issue with some of the tactical details of this book. However, as General Trudeau cites, "We have no grounds for brushing off as worthless any concept for atomic combat." This stimulating book is the result of examining many approaches to combat with atomic weapons and it does present soundly based concepts and solutions to tomorrow's problems. Well experienced in dealing professionally with problems of nuclear warfare, both of the authors are qualified military-nuclear authorities who have produced a clearly drawn book packed with modern facts—a text vital to the libraries of soldiers of all ranks.

Soviet nuclear armament and other military advances are covered mainly in terms of new weaponry and technological progress. This chapter harks back to the title of the opening chapter, "It's Later Than You Think," and it warns that there is no basis for U. S. complacency. The Soviet weaponry illustrated here and the facts cited alongside, show the ominous nature of a potential foe whose ground equipment—from king-size mortars to tank chassis-mounted ballistic rockets—is backed by an R & D and production technology as modern and vigorous as that segment that sent a satellite beyond the moon. Here, in relation to modernized Soviet Army ground weapons, General James M. Gavin's earlier testimony in Congress rings again with authoritative warning.

Having given the reader a well grounded education in nuclear tactics and technique the authors indulge in a bit of crystal ball gazing. Based on what they have achieved up to page 236, they are entitled to it. It would be stealing their nuclear thunder to reveal all of the contents of this last chapter. However, the authors project their subject with imagination properly anchored to military reality. Will platoons some distant day fight for nations in place of armies? The authors project the possibility:

> Looking even further into the future, we can discern more radical changes. There will be no relation to present-day tactics at all. Opposing armies are preferably separated. There are not even outposts in contact. An attack is heralded by large scale atomic bombings of the enemy, a vast number of small airborne landings conducted at high speed, and a general attempt to paralyze the enemy controlled area in a matter of days. The attack may be directly on the enemy's home country. The defender, disposed in small mobile groups throughout his country, will depend on counterintelligence to ward off the effects of the initial attack, and on retaliation and rapid movements with split-second time schedules to defeat the enemy. Such a fight may take place over thousands of square miles and involve the bulk of the armies of the two countries simultaneously.
>
> Combat is on a global scale, but the fighting between units is at platoon level. The platoon leader controls weapons that could have destroyed armies. Leadership is at a premium. In the hands of the platoon leader and his noncommissioned assistants may rest the fate of the country. We will have come full circle; the great massed armies will dissolve and we will return to the elite professional units of Oliver Cromwell and Gustavus Adolphus. Thus, the soldier will have to understand, at a minimum, what is contained in this book; the officer will have to have leadership to a degree heretofore unknown—the lieutenant must be prepared to discharge almost the degree of responsibility now associated with general officers. The armies will be very small by present day standards, but the quality will more than make up the quantity. Technical knowledge and courage in the face of terrible weapons will be a mark of the military man of the future.
>
> There are so many ways that combat may go in the future, that our ideas have been presented for thought only. We cannot say that these tactics will be used—something radically different may result. We do say, though, that the mental processes which produced the atomic weapon can produce means which will permit the soldier of the future to utilize atomic weapons to assist him. This will only come about if the soldier is ready to change his approach to tactics in a rapidly changing world.

Feature Reviews

Exclusive with

ARMOR

As this book will reveal, tactically we are keeping up with the power of the weaponry at our disposal, but logistically there are tons of problems as yet unsolved. Here, there are also crucial paths to navigate in arriving at basic solutions. The authors might consider producing a logistical companion piece to this book.

Summed up, *Nuclear Tactics* is singular in its field, simple in its explanation, and certain to be published and read in Russia—but without consent of the authors.

Binders for..... *ARMOR*

- Provide protection for copies of ARMOR which are now being used as reference.
- Easy to insert, twelve big issues, a full two-year file, all in one binder.
- The cover is decorated with imprints of title ARMOR, and seal of Armored patch.
- It is also ideal protection for reference copies now in your company day-room.
- Order your personal or unit ARMOR binder NOW! . . . they are still available.
- We will pay shipping cost if your check or money order accompanies the order.

$2.75

PLEASE KEEP US INFORMED OF YOUR CORRECT ADDRESS

ORDER FORM BOOKS BINDERS - *Armor*
1757 K Street, N.W., Washington 6, D. C.

Please send me the following:

_____

_____

_____

_____

_____

_____

NAME (Please Print)

ADDRESS (Street or Box Number)

CITY (Town or APO)

STATE

☐ I enclose $.....
☐ Bill me. (Members only.)
☐ Bill unit fund.

Science and Technology in Contemporary War

By GENERAL G. I. POKROVSKY

$4.50

Translated by Raymond L. Garthoff

Today's innovations in technology are greatly influencing the planning of military strategy, and will ultimately determine the course of future wars. This book from behind the Iron Curtain is composed of selections of the most important writing of Russia's foremost spokesman on space-age military matters. It surveys a broad number of scientific and technical fields, and illustrates the impact of the development of science on military affairs. While occasionally there is a propagandistic or ideological passage, on the whole the book is a sober and serious study, of special interest to Americans as a revelation of Soviet interest and lines of thought.

Specific weapons systems are examined, including the hydrogen bomb, the ICBM, air defense missiles and vertical-takeoff aircraft. Particularly significant is the indication of the awareness, at least by senior Soviet experts, that the ICBM is no "ultimate" weapon. Alternate strategic systems are discussed, including earth satellites and balloons, as well as aircraft.

War and the Soviet Union

Nuclear Weapons and the Revolution in Soviet Military and Political Thinking

By HERBERT S. DINERSTEIN

$5.50

The appearance of nuclear weapons and of the vastly improved vehicles for their delivery has caused the great powers to re-examine their fundamental ideas about warfare. In WAR AND THE SOVIET UNION, Herbert S. Dinerstein examines the military and political consequences of the revolution in Soviet strategic thinking. His work is brilliantly researched and meticulously documented. Its analysis and evaluation of Soviet thinking about the problem of surprise attack and of first strike make it a work of the very first importance.

The book gives a detailed account of the unprecedented controversy on military theory which raged in the Soviet Union after 1953 and was resolved only with Malenkov's political defeat. Once the Soviet leaders had recognized that the nature of war had changed, several vital questions had to be answered. Was it possible to win a nuclear war if the opponent enjoyed the advantage of surprise? Was there any profit in such a victory? Even if the Soviet Union did not want a full-scale nuclear war at a particular moment, did she not have to be ready to strike a pre-emptive blow, to "hit back first?" Do the Soviet leaders who write and talk about pre-emptive blows in reality mean preventive war? WAR AND THE SOVIET UNION gives the Soviet answer to these questions.

AN INVESTMENT IN KNOWLEDGE

Every year there are published many books, magazine articles and papers on military subjects. You probably have shelled out a lot of coins for many of them in an attempt to keep up with the latest information relative to your field.

If that is true you'll be happy to learn that you no longer need purchase two, three, four or more publications to get this needed information. Now at the small cost of only a few pennies a day, you can get a magazine that is designed exclusively for your professional needs. The magazine is: ARMOR, *The Magazine of Mobile Warfare. You are holding a copy of it in your hands this very moment. In all probability you have just finished reading it—perhaps for the first time—and satisfied yourself that it is the only magazine you will find that is devoted to the complete coverage of mobility in warfare.*

So why not take advantage of this unique reader service—a service that takes the guesswork out of your military reading and provides issue by issue proof that an investment of only a few pennies a day is the best investment you can make in support of your military career. (In addition, during the interim months, you will receive the Association's Newsletter.)

ARMOR THE MAGAZINE OF MOBILE WARFARE

DOMESTIC RATES:

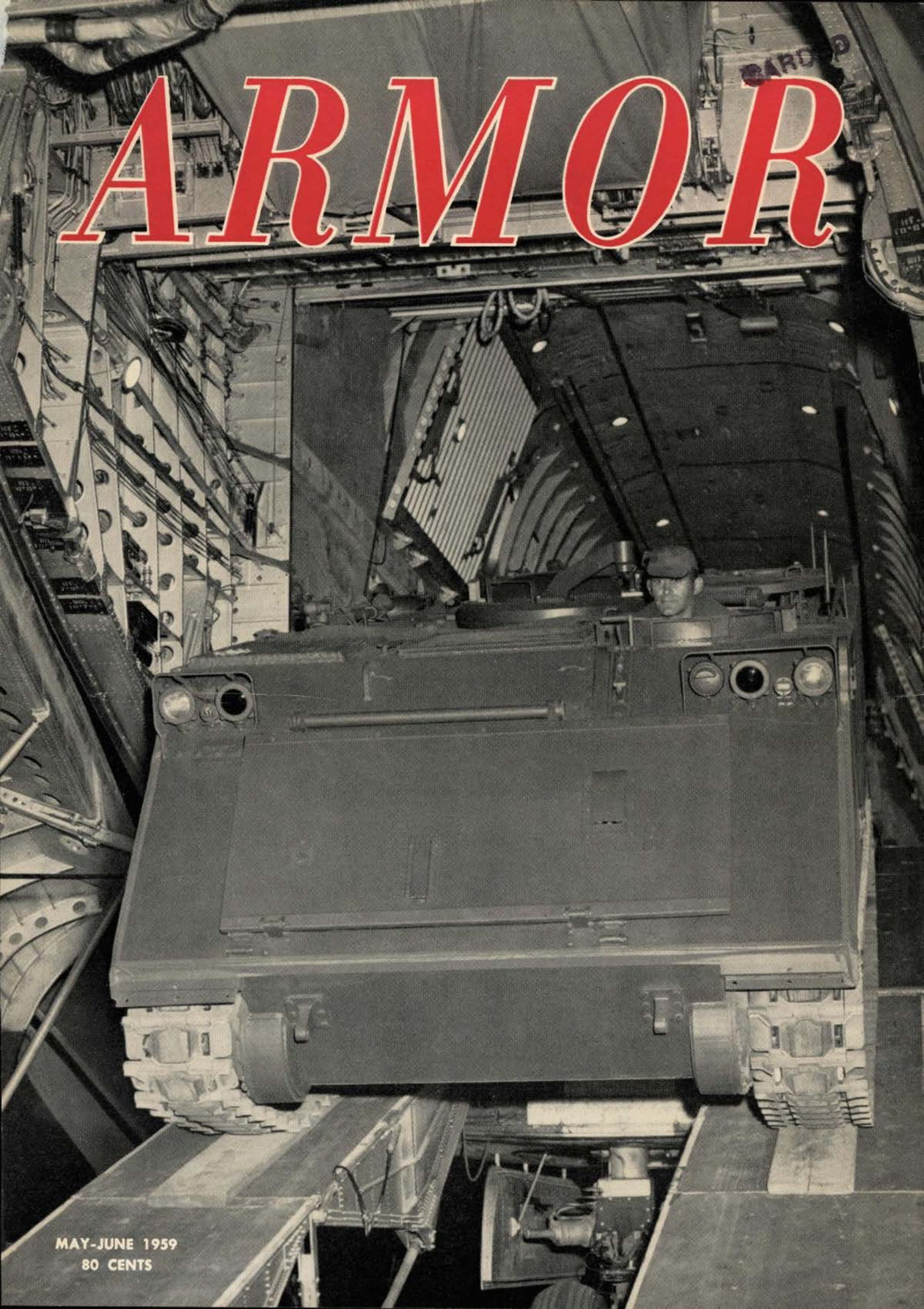
☐ $4.75 one year
☐ $8.00 two years

FOREIGN RATES:

☐ $5.50 one year
☐ $10.00 two years

DOMESTIC CADET RATE—$3.00

ARMOR



MAY-JUNE 1959
80 CENTS

Seven Roads To Moscow

$7.50

By W. G. F. JACKSON

The theory that Russia is impermeable to invasion was established by Napoleon's retreat from Moscow and confirmed by the German failure during the last war. The author's thesis is that these two invasions, in spite of the military genius of Napoleon and the technical superiority of the Germans, were bound to fail because they pitted themselves against the immense natural defensive strength of the Russian lands.

In this outline of Russian history, the author tells the story of the principal invaders of Russia—Rurik the Viking, Batu the Tartar, Sigismund of Poland, Charles XII of Sweden, Napoleon, Hindenberg and Hitler. Of these, the only permanently successful invasion from West to East has been that of the Vikings. Its military success was effected because it advanced down the great rivers instead of across them. Its permanence derived from the fact that instead of wasting the Russian lands it brought constructive services to the inhabitants and enlisted their co-operation.

Political and military conditions have changed enormously since Rurik, even since Napoleon, Hindenberg and Hitler. But the study of these campaigns, especially the last three, which are analysed in lucid detail, is not merely academic, for the classic principles of strategy are unchanged. Recent weapons have not entirely neutralized geographical advantages: the vast extent of Russia remains a most powerful defensive asset, even when troops and supplies are airborne. The moral factor, which permits the Slavs to abandon whole tracts of territory without a sense of psychological defeat, is still operative: it may even be intensified by the present political organization.

The Army Almanac

$8.95

THE ARMY ALMANAC is a new and completely revised commercial edition of a book published in 1950 by the Government Printing Office for the Department of the Army.

Particular care has been taken by the many individuals in the Army and other agencies who provided source material to insure its accuracy.

THE ARMY ALMANAC covers in detail the combat arms, including Army Aviation, and the various administrative and technical services. It gives details of organization and strength. It covers the Army Reserve and the Army National Guard. Army pay and allowances, training and education are adequately covered, as are Army weapons, the supply system, rations, military construction, the Corps of Engineers' civil works, transportation, signal communications, medical care, military intelligence, military justice, research and development, awards and decorations, uniforms and insignia, Army flags, selective service, the combat arms regimental system, famous sayings—even Army slang.

A separate chapter lists general officers of the Army by name and grade. There is also a list of the names of the Army winners of the Congressional Medal of Honor.

The major and minor wars of the United States are covered in a superb condensed military history. Included are a detailed chronology of battles and events from 1774 to 1958 and the combat records in recent wars of the major Army units.

The Veterans Administration and veterans' benefits are explained as are military funerals and national cemeteries.

Civil affairs and military government are covered. There is a summary of the contribution of the Army to the development of our Nation, such as exploration, public works, public health and disaster relief.

Included in the Almanac are short descriptions of the U. S. Navy, the U. S. Air Force and the Department of Defense.

A comprehensive topical index and a separate name index will permit the busy reader to find any desired information quickly.

The United States Armor Association

(Established 1885)

President
LT. GEN. GEORGE W. READ, JR.

Honorary President
MAJOR GENERAL GUY V. HENRY, Ret.

Vice Presidents
MAJ. GEN. DONALD W. MCGOWAN, NG
MAJ. GEN. JOHN L. RYAN, JR.
MAJ. GEN. WM. M. STOKES, JR., Ret.

Honorary Vice Presidents
GENERAL JACOB L. DEVERS, Ret.
GENERAL WILLISTON B. PALMER
GENERAL WILLARD G. WYMAN, Ret.
LT. GEN. EDWARD H. BROOKS, Ret.
LT. GEN. JOHN H. COLLIER, Ret.
LT. GEN. WILLIS D. CRITTENBERGER, Ret.
LT. GEN. HOBART R. GAY, Ret.
LT. GEN. ALVAN C. GILLEM, JR., Ret.
LT. GEN. GEOFFREY KEYES, Ret.
MAJ. GEN. ERNEST N. HARMON, Ret.
MAJ. GEN. JOHN C. MACDONALD, Ret.
BRIG. GEN. SIDNEY R. HINDS, Ret.
BRIG. GEN. WILLARD A. HOLBROOK, Ret.
BRIG. GEN. HENRY CABOT LODGE, USAR
BRIG. GEN. PAUL M. ROBINETT, Ret.
BRIG. GEN. HARRY H. SEMMES, Ret.

Secretary-Treasurer
LT. COL. WILLIAM H. ZIERDT, JR.

Executive Council
GENERAL BRUCE C. CLARKE
LT. GEN. CLOVIS E. BYERS
MAJ. GEN. HOMER O. EATON, JR., NG
MAJ. GEN. ROBERT E. FRANKLAND, NG
MAJ. GEN. LOUIS V. HIGHTOWER
MAJ GEN. ALBERT S. JOHNSON, NG
MAJ. GEN. HARRY W. JOHNSON
MAJ. GEN. W. P. JOHNSON
MAJ. GEN. ALMERIN C. O'HARA, NG
MAJ. GEN. ANDREW P. O'MEARA
MAJ. GEN. ROBERT W. PORTER, JR.
MAJ. GEN. MAXWELL C. SNYDER, NG
MAJ. GEN. THOMAS E. VAN NATTA
MAJ. GEN. EDWARD O. WOLF, NG
BRIG. GEN. CHARLES G. DODGE
BRIG. GEN. JAMES I. KING
BRIG. GEN. HAL C. PATTISON
BRIG. GEN. W. H. S. WRIGHT
COL. FREDERIC W. BOYE, JR.
COL. ANDREW J. BOYLE
COL. JAMES H. CRITCHFIELD, USAR
COL. SAMUEL MCC. GOODWIN
COL. LAWRENCE V. GREENE
COL. WILLARD WEBB, USAR

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR
Lt. Col. William H. Zierdt, Jr.

BUSINESS MANAGER
M Sgt J. William Joseph

ASSISTANT TO THE EDITOR
Sfc Michael E. Kekker

CIRCULATION MANAGER
M Sgt William Coley, Jr.

Volume LXVIII MAY-JUNE, 1959 No. 3

CONTENTS

LETTERS TO THE EDITOR 2

REVISION OF THE ARMORED CAVALRY REGIMENT 5
By Colonel John A. Beall, Jr.

THE M113 ARMORED PERSONNEL CARRIER 8

WHICH METHOD? 10
By First Lieutenant William C. Haponski

EDITORIAL 14

LET'S MAKE THE TANK CREW PENTOMIC 16
By Captain Norbert Brandon

Q—STAR 18
By Major Donn A. Starry and Captain Vernon A. Quarstein

MACHINE GUN TRAINING: A Neglected Subject 37
By First Lieutenant Richard M. Meyer

IS THE SEA MISTRESS FEASIBLE? 40
By Major John C. Burney, Jr.

STRAC 43
By Colonel Vernon R. Rawie

EDUCATION AND THE SOLDIER 48

LOGISTICAL TRAINING 50
By Captain Edward L. Waggener

A SAVING IN MAINTENANCE TIME 52

NEWS NOTES 54

HOW WOULD YOU DO IT? 57
A U. S. Army Armor School Presentation

FROM THESE PAGES 59

THE BOOK SECTION 60

THE TANKS: 1914-1945 60
Reviewed by Colonel Robert J. Icks, USAR, Retired

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and editorial offices: 1757 K Street, N.W., Washington 6, D. C. Copyright 1959, by the United States Armor Association. Second-class postage paid at Washington, D. C. and at Additional Entry. Terms: Domestic subscriptions, including APO's, $4.75—one year and $8.00—two years. Foreign, including Canada & Pan America, $5.50—one year and $10.00—two years.

LETTERS TO THE EDITOR

On the M60 and Armored Artillery

Dear Sir:

The article on the M60 tank in the March-April issue was a welcome and informative preview of this new vehicle. However, there are a couple of points which should be brought to your attention, both in the interests of accuracy and for the sake of argument.

On page 13, you state that "preliminary tests reveal that fuel *compression* was considerably less in the diesel engine than the present gasoline engine." I am sure that the italicized word is a typographical error and that the word intended here was *consumption,* rather than *compression.* The statement as presently written would be contrary to the principles of diesel operation.

My next point lies more in the field of opinion, rather than fact, but here it is for what it is worth. I think that you will find that exceptions will be taken to your premise that because fuel consumption of the idling diesel engine in the M60 is less than that of the present auxiliary engine at full load, the need for a "Little Joe" in the new tank as a source of electrical power generation is eliminated. My contrary view is based on the following:

• Irrespective of fuel savings that might occur, the wear-and-tear on a twelve-cylinder main engine resulting from long periods of high speed idling, often necessary to maintain batteries at full charge during continuous operation of the tank's electrical and communications equipment, would hardly justify the elimination of some form of auxiliary power generation.

• Rather than comparing the gasoline Little Joe's inefficient fuel consumption with that of a diesel main engine, it would appear that a more accurate comparison could be made by testing a suitable, small diesel auxiliary and measuring its fuel consumption against that of the diesel main engine. In this connection, the marine engine industry is now producing with considerable success lightweight, small, aircooled diesel engines in one, two, and three cylinder configurations. These engines develop from five to sixty brake horsepower over a wide range of operating conditions with very low fuel consumption during long periods of continuous speed. Further, they are designed for operation and maintenance in the cramped confines of small craft engine compartments. Such engines would offer a good starting point for the development of a compatible auxiliary for our new tanks.

• Admitting the desirability of all the extra fuel tank capacity possible, we may find ourselves paying a high price for it as a result of eliminating the auxiliary. In addition to the increased maintenance problem, other factors may also be important in a combat situation. Two that come readily to mind are the higher noise level of the unmuffled exhaust of the main engine as compared with a small muffled auxiliary, and the large infra-red output of a large engine contrasted with a small one. This latter characteristic could greatly increase the tank's susceptibility to IR detection during static periods when it is necessary to keep batteries charged.

Having gotten this off my chest, I would like to inject a laudatory note regarding the very fine article by Brigadier General William F. Ryan on "Artillery in a ROCAD Division." General Ryan's observations on the need for battery and battalion tests specifically designed to prepare armored artillery for combat and his viewpoints on the employment of armored artillery are very well stated, as were his comments on the need for certain organizational changes. In my own limited experience, I have found a lack of both knowledge and appreciation of the exceptional capabilities, techniques of employment, and flexibility of armored artillery. This has been so not just among tankers and doughboys, but artillerymen as well. This seems to stem from a continuing tendency to regard towed artillery as the basic means of fire support in future combat operations. I hope that the 4th Armored Division's well-thought out concepts for training its artillery to displace rapidly and go into action "shooting from the hip," so to speak, eventually permeates all field artillery doctrine and practice.

I believe that there should be more articles of this nature in *ARMOR* because they serve to further the *concept* of Armor as an integrated battlefield team of the mobile combined arms and services, each contributing its unique capabilities to the efforts of the whole. This makes our Association publication truly the "Magazine of Mobile Warfare," rather than a purely branch journal of narrow interest. With this in mind, I would like to suggest in closing, that efforts be made to publish a series of issues containing articles written by the commanders of all major type elements within the ROCAD division. These articles should be beamed at giving *ARMOR* readers an insight into the operational problems with which these commanders are confronted, as well as their views on training, equipment, adequacies of current organization and doctrine in application, and recommendations for improvement. I would emphasize that such a series would cover not only combat and combat support units, but also the major elements of division trains, the aviation company and administration company. I feel that the major problems of the ROCAD division probably lie more in these latter important areas, which are probably discussed the least.

LIEUTENANT COLONEL D. S. CASON
Department of the Army
Washington 25, D. C.

• *The word should have been "consumption." Also we erroneously called the cover shot an "M44." Actually it is an "M52."* ED.

The M60 Tank

Dear Sir:

Congratulations to *ARMOR* on your fine and very informative article on the new M60 Medium Tank, which appeared in the March-April issue. This tank is of particular interest to the Cadets in Armor ROTC as it will be in use

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1959 by the United States Armor Association.

Reprint Rights: All Rights Reserved.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of Armor is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1757 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the even months of the year: *i.e.*, Dec. 25 for Jan.Feb issue, Feb 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

during the first years of their service in the Army.

ARMOR's coverage of new developments is excellent and is of great help in keeping the student informed. Could you in the future cover the new T92 Light Tank and the T113 Armored Carrier, which were pictured in the Army *Progress Report for 1958*? Information concerning these new armored developments would be of great interest to all.

The Armed Forces Club of the Virginia Military Institute would greatly appreciate any material that you could send to us concerning these new vehicles, especially in the line of pictures which could be used for the Club's display board.

The Armed Forces Club is an organization comprising more than 200 cadets from all academic classes with an expressed interest in military activities and developments within the armed forces.

CADET STEPHEN M. SLATTERY
Armed Forces Club
V.M.I., Lexington, Virginia

• *See page 8.* ED.

Training Management

Dear Sir:

Dr. Robert A. Baker's article on training management is the most encouraging and refreshing critique of our training program that I have seen. He has cut keenly into the problem, casting aside the gloss of neat lesson plans, "pencil" range scores and white wash inspections.

Though some of his proposed remedies are expensive, most are not, and we could incorporate them in our programs today.

The "examination" phase of instruction is a failure! We are too rushed to ever follow through on it! It is absolutely the most important phase! Testing takes time and perseverance by tank commanders, platoon leaders and troop commanders.

Inspections by higher headquarters should be stopped and their time devoted to preparing tests such as Seventh Army's Tank Crew Proficiency Course and the Tank-Infantry Platoon Combat Course. Leave the troop commander two or three un-inspected months to prepare for such tests. Let him stand or fall on the results. I sincerely believe higher level commanders would be shocked at the increased activity and productivity at the tank crew level. It is much easier to set up an eye wash inspection class than it is to insure 80 or 90 percent retention of subject matter by the soldier.

As Dr. Baker so aptly pointed out, if lower unit commanders are to conduct their own training they must be supported. Time must be allowed for housekeeping. "Extra-curricular" athletic and weapons teams cannot be levied out of training units.

In place of Technical Inspections and CMIs give units a march order to a firing range. It could be in the form of a two-hour practice alert. Let the inspector count the number of vehicles that could move. Have all weapons fired. Count the number that were not functioning. Establish a radio net and see how many stations check in. A unit that can pass such an inspection can "move, shoot and communicate!"

Such tests and checks as these would demand a sense of training responsibility at the lowest level. Tank commanders would train their crews! Platoon leaders would train tank commanders. This "apprenticeship method" would insure retention of instruction. Each level of command would depend on a realistic performance by subordinates. Incentive would be high! Professionalism and competence at all levels would grow!

I commend Dr. Baker!

FIRST LIEUTENANT WILLIAM E. ODOM
CoD, 6th ACR
Fort Knox, Kentucky

Refueling Practices

Dear Sir:

I read Captain R. M. Seton-Browne's interesting note on the English approach to "rapid refueling" in last month's issue of *ARMOR*. In 1958 during operation STRONGBACK in north central Luzon, our tank company used a similar method of rapid refueling except we employed the standard 55 gallon gas drums and the hand dispensing gas pump which is a vital part of our OVM gear. Cargo trucks (2½ ton 6x6 M35 models) would pass by our tanks, and one man would roll off two or three drums per tank as needed. A tank crewman attached the pump's nozzles, and gas was transferred from ground to tank immediately. This rapid simultaneous method necessitated minimum manhandling. Another good aspect of this method was that it permitted good tactical dispersion and allowed the remaining crewmen to perform maintenance duties or act as ground or air alert security. When the company moved out, the trucks would quickly police the area of empty drums and return to the fuel dump. Generally, one truck could support a platoon of tanks.

FIRST LIEUTENANT B. M. MACLAREN
Headquarters Battalion
Headquarters, U.S.M.C.
Washington 25, D. C.

Out of Print Books

Dear Sir:

Major General John K. Herr's book, *The Story of the U. S. Cavalry*, mentions two publications that I am very interested in obtaining:

History and Pictorial Review, Sixth Cavalry. Baton Rouge, Louisiana, 1941.

From Yorktown to Santiago with the Sixth U. S. Cavalry. Baltimore, 1900. by Maj. General Wm. Harding.

I have tried to obtain one copy of each of the above mentioned publications from several different book companies, but have had no luck.

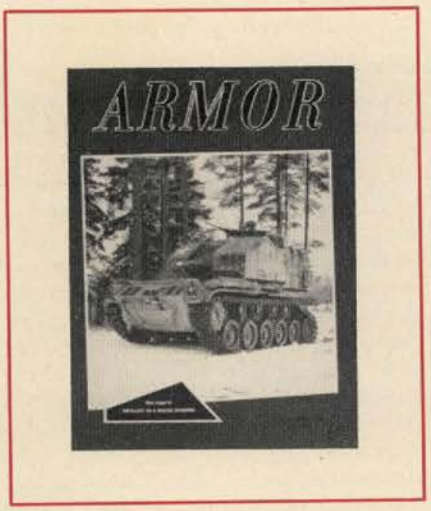
I write to you in the hope that one of the readers of *ARMOR* may know where to obtain these books.

SECOND LIEUTENANT E. N. VOKE
614 North Shore Road
Norfolk 5, Virginia

• *If anybody can supply these books please contact the writer or this office. Incidentally, General Herr's book is also out of print. This office would like to locate two copies of this book. Any assistance will be appreciated.* ED.

THE COVER

The cover photograph, taken by the Food Machinery and Chemical Corporation, depicts the new M113 Armored Personnel Carrier inside the C130 Air Cargo Transport. This vehicle will replace the M75 and M59 APCs. Capable of air transport and airdrop, the M113 increases the ground mobility of our Army. (See Story—Page 8.)



It is an M52! ! !

Dear Sir:

I think you made a mistake in nomenclature on your March-April cover. You list the vehicle in your cover credit section on page 3 as being an M44 self-propelled artillery piece. I believe you will find it is actually an M52 self-propelled artillery piece.

The M44 is a 155mm howitzer, self-propelled; while the M52 (cover photograph) is a 105mm howitzer, self-propelled. The carriages are similar but the turrets are different.

Lieutenant Jay W. Woodbeck
2d Guided Missile Group
Fort Bliss, Texas

• *We often wondered whether our readers looked at the cover credit box on page 3. Now we know because we have been getting letters on this mistaken nomenclature.* Ed.

Correct Dates for the 6th Armored Division Association

Dear Sir:

On page 2 of the Association's Newsletter for March you published the dates for this year's convention of the various Armored Division Associations. The correct dates for the 6th Armored Division Association meeting are 3-4-5 September. This Association always meets over Labor Day weekend. We hope to see many of our comrades at the Sheraton Hotel, Louisville, Kentucky, this year.

Edward F. Reed, Secretary
6th Armored Division Association
P.O. Box 492
Louisville, Kentucky

Civil War Maps

Dear Sir:

My attention has been called . . . by Lieutenant Colonel Robert C. Kinkor . . . to your fine September 1956 article *"Maps for the Civil War,"* by Colonel H. V. Canan.

This is by far the best paper on the subject I have read.

It is of particular interest to us because it supplies just the kind of information we have wanted in working on plans to help the Civil War Centennial Commission in its program for adequate commemoration activities for 1961-65.

As producer of the 3-dimensionally-formed raised relief edition of one of the Gettysburg Battlefield maps from the Atlas to Accompany the Official Records of the Union and Confederate Armies 1861-65, and of scale models of historic sites, we indeed commend you for your excellent coverage of the Civil War map subject. Our compliments to Colonel Canan.

Edmund M. Pitts

Aero Service Corporation
Photogrammetric Engineers
210 East Courtland Street
Philadelphia 20, Pennsylvania

On ROTC Awards

Dear Sir:

We have received the package of books to be included with the one-year gratis membership in your association as an award to our top graduate choosing Armor as his basic branch.

If your association has been presenting awards previously to ROTC graduates we were not aware of the fact. However, as a PMST who is confronted with an abundance of administrative paper work, I should like to express my individual appreciation for your method of making this award. Unlike awards from other service organizations and associations your award demands only a minimum of administrative processing and relies upon the judgment of ROTC instructor personnel to determine the recipient. Further than this minimum demand on the ROTC Staff, however, is the practicality of your award.

Your award is useful, meaningful, lasting, educational and I feel, more highly desired than a cup or plaque or medal which cannot be utilized by the recipient once he dons an Army uniform.

Please accept my congratulations on your choice of an award. We shall be pleased to make our selection of a student to receive the award and will forward his application for membership in your association as soon as the individual is determined.

Major Harold A. Jenkins
PMS&T
South Carolina State College
Orangeburg, South Carolina

• *This is the first year we included all ROTC institutions under the GMS program. We appreciate the kind remarks and hope that we are furthering the aims and purposes of our Association by giving such awards. We hope to be able to continue the awards next year. It all depends upon our financial status at the time.* Ed.

Rapid Refueling

Dear Sir:

The letter in the March-April issue from Captain R. M. Seton-Brown, Wilts, England, on Rapid Refueling, comes as no surprise to some of us who have been concerned with selling bulk refueling and development of the necessary equipment. As he doubtless knows, we have some in our ranks that belong to the 5-gallon can school. Arguments, pro and con, could go well into the night if we limit our conversation to personal opinion. Let's look at some facts.

The U. S. Army has never considered that the 5-gallon can would be replaced by bulk refueling. At best, we expected that 80% of the gasoline could be distributed in bulk. The remaining 20% would be distributed to using vehicles in 5-gallon cans to take care of those situations where bulk refueling is impossible. Maneuvers in Europe and Louisiana have confirmed the accuracy of these estimates.

Tests conducted by The U. S. Army Armor Board at Knox under field conditions show a significant reduction in refueling time from the standpoint of both a tank platoon and an individual tank to say nothing of more efficient manpower utilization. The 1200-gallon bulk refueler required 30% less time to refuel a platoon of M48A2 tanks than was required using 5-gallon cans. The bulk refueler increased delivery rate to an individual tank by over 500%. We believe both of these figures are significant.

The U. S. Army Armor Board tests also showed that the 5-ton cargo truck with bulk refueler could go anywhere, in about the same time that it could with the same quantity in 5-gallon cans. In situations where bulk refueling is impossible, the 5-gallon cans from the tank are filled from the refueler. What have we lost by using the bulk refueler in these situations?

Tests did not show a significant increase in maintenance. It is not unreasonable to expect that overall maintenance would be reduced because of more efficient utilization of cargo vehicles as part time bulk refuelers.

It is understood that the UK tried bulk refueling with a commercial tank truck that was unable to get off-road. Failure under these conditions could be expected. It was suggested that the UK borrow one of the U. S. bulk refuelers for test on a military vehicle.

We believe the advantages of bulk refueling have been proven beyond doubt, particularly when used in conjunction with the 5-gallon can.

Colonel Michael S. Davison
Chief, Combat Materiel Division
Office of the Chief of R&D, D/A
Washington 25, D. C.

(U. S. Army)

Revision of the Armored Cavalry Regiment

By COLONEL JOHN A. BEALL, JR.

Introduction

UNDER the provision of AR 310-31, Headquarters U. S. Continental Army Command (USCONARC) in 1957 began a review of the TOE for the Armored Cavalry Regiment (TOE 17-51R). This was a regularly programmed review accomplished every three years to update organizational structures in consonance with changes in equipment and concepts of operation.

Comments and recommendations from units and from the U. S. Army Armor School were received and reviewed by Headquarters USCONARC. In general, these comments indicated that the basic structure was sound. Revisions were recommended, however, which would improve the overall combat effectiveness of the organization. The following areas were determined to need revision:

1. The squadrons of the regiment should be logistically self-sufficient to the degree necessary to permit them to operate semi-independently.
2. The surveillance capability of the regiment should be increased by the integration of such surveillance equipment as was currently available.
3. The aerial reconnaissance capability should be increased by the addition of light aircraft, drones and aerial surveillance equipment.

Department of the Army provided certain guidance in this reorganization including the guidance that the overall personnel strength of the regiment should not be increased. Changes in any area that required increased personnel strength, therefore, had to be compensated for by corresponding personnel reductions in other areas.

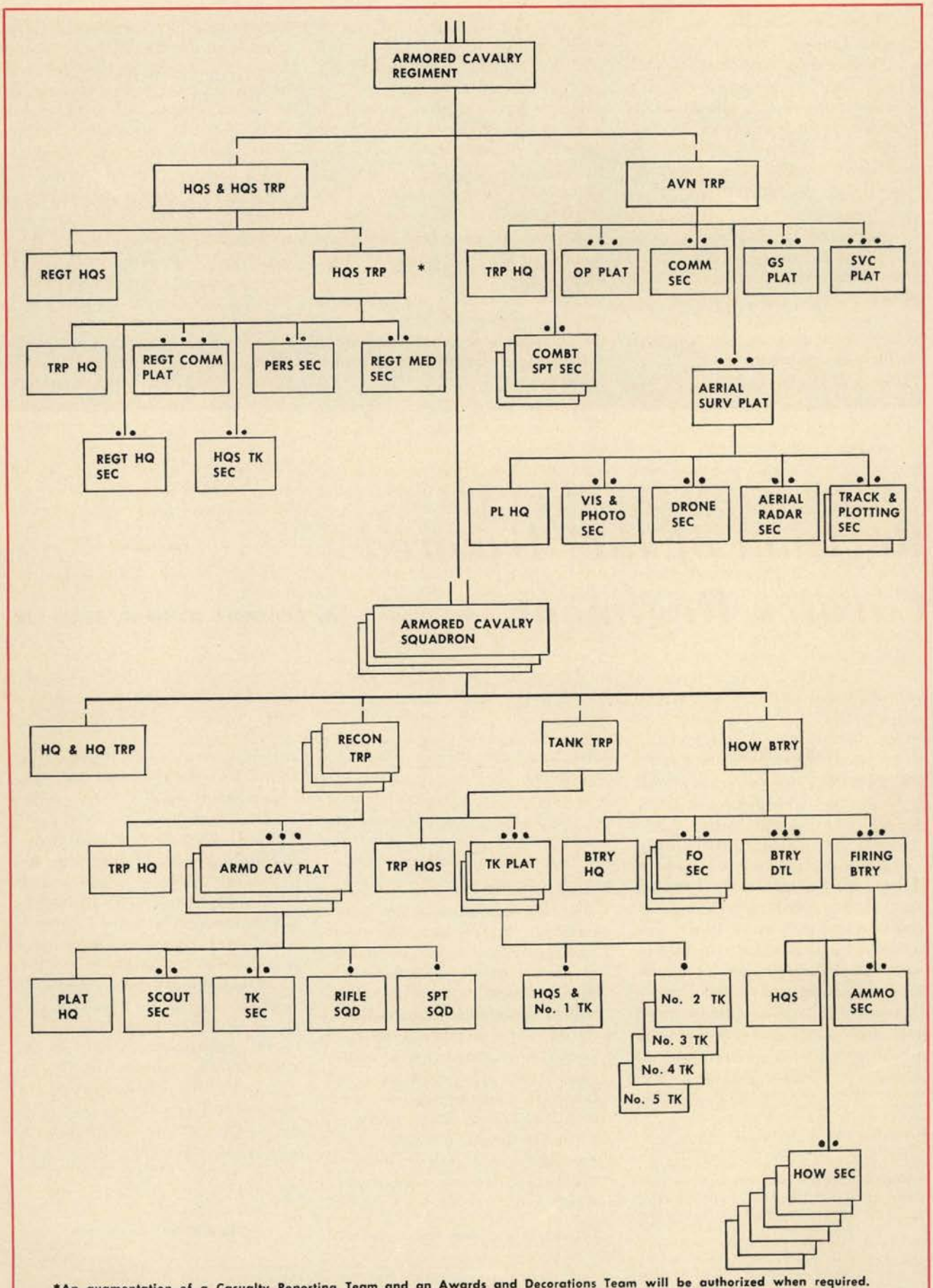
Based on these recommendations and this guidance, Headquarters USCONARC with the assistance of the U. S. Army Armor School submitted to Department of the Army a concept for a revised regimental organization in late 1958. On 23 December 1958 the Department of the Army approved a plan for the revised organization. Detail TOEs are now in process of preparation and will be published after approval by the Department of the Army. Reorganization of Armored Cavalry Regiments under the revised structure will follow. An organization chart of the revised structure to be known as TOE 17-51D is shown on page 6.

Significant Changes

The significant differences between the current and the revised organization are indicated below:

New Unit Designations. The current

COLONEL JOHN A. BEALL, JR., Armor, graduated from USMA in 1935. During World War II he served in Europe with the 2d Armored Division. Subsequent assignments included Third Army, Constabulary, OCAFF and D/A. Graduating from the Air War College in 1951 he became the Armor instructor at the Air University. Next he was Chief of Staff, 45th Infantry Division, then Senior Advisor to VI Corps, Korea. Returning Stateside he was G1, later G3, III Corps, Fort Hood. He is Deputy for Armor, Office of the Special Assistant to the Commanding General for Combat Arms, USCONARC.



The revised Armored Cavalry Regiment

Regimental Headquarters and Headquarters Company will be redesignated Headquarters and Headquarters Troop. The Reconnaissance Battalion will be redesignated Armored Cavalry Squadron to indicate its security, offensive and defensive potential as well as its reconnaissance capability.

The former Battalion Headquarters and Headquarters Company, Tank Company and Reconnaissance Companies will be redesignated as Troops in consonance with traditional Cavalry designations. The Howitzer Company will be redesignated Howitzer Battery in consonance with approved Artillery designations.

Deletion of Regimental Service Company and Medical Detachment. Both of these units have been deleted from the revised organization and, in general, their functions, personnel and equipment distributed to the three Squadron Headquarters and Headquarters Troops and Regimental Headquarters and Headquarters Troop. The Regimental Personnel Section has been drastically reduced and its personnel redistributed. These actions enable the squadrons to be logistically and administratively independent to the degree necessary to permit them to operate independently, although the regimental commander retains overall logistical and administrative supervision. Sufficient medical and personnel spaces have been left in Regimental Headquarters Troop to service that organization and the new Aviation Troop. Both Regimental Headquarters Troop and the Aviation Troop contain organizational maintenance and supply personnel.

Addition of an Aviation Troop. The number of aircraft organic to the regiment has been increased from eight to 26 including fixed wing observation and utility aircraft and rotary wing light cargo and reconnaissance aircraft. An Aviation Troop has been added at regimental level and all organic aircraft incorporated into this troop. In addition to its General Support Platoon of fixed and rotary wing aircraft, the Aviation Troop has three Combat Support sections of one fixed wing and one helicopter each. An Aerial Surveillance Platoon organized as indicated in the organizational chart has also been provided in the Aviation Troop. An Operations Platoon including facilities for ground control approach and air traffic control has also been included. An organic Service Platoon will provide aircraft maintenance and airfield service. The Aviation Troop as contemplated will greatly increase the capability of the regiment for reconnaissance and surveillance.

Reductions at Regimental Level. The transfer of logistical and administrative functions to the squadrons has made possible the reduction of personnel required at regimental level. The new Regimental Headquarters and Headquarters Troop has approximately one-third less personnel than the company it replaced, resulting in a streamlined command and control organization.

Additional Surveillance Equipment. As can be seen from the chart, drones, aerial cameras and aerial radar have been included in the Aerial Surveillance Platoon of the Aviation Troop. In addition, ground radar has been integrated into the Squadron Headquarters, its Reconnaissance Troops and the Tank Troop. These additions increase the surveillance and target acquisition capability of the regiment.

Substitution of Medium Gun Tanks. The revised TOE will provide that medium gun tanks may be substituted for light gun tanks throughout the regiment when authorized by the theater commander. This will enable major commanders to greatly increase the regiment's offensive and antitank capabilities when employed in an area requiring such increases.

Minor Changes

Many minor changes have been made throughout the regimental structure in consonance with recommendations from the field. These will be reflected in the published TOE. A few of these changes are as follows:

Minor personnel and equipment differences will be noted between the former Tank Company and the new Tank Troop. The differences are: The addition of a Security Section in the Tank Troop Headquarters and the reduction of tank crews from five to four men each. These changes will make the Tank Troop identical to the tank companies of Armored Divisions and Nondivisional Tank Battalions except for the type radios authorized. There has been no change in the number of medium tanks (17) nor other major items of equipment.

Minor changes have also been effected in the Howitzer Battery. These include an increase in the number of Forward Observer Sections from one to three, an increase in the Firing Battery Headquarters and a substitution of two 5-ton for three 2½-ton ammunition trucks in the Ammunition Section.

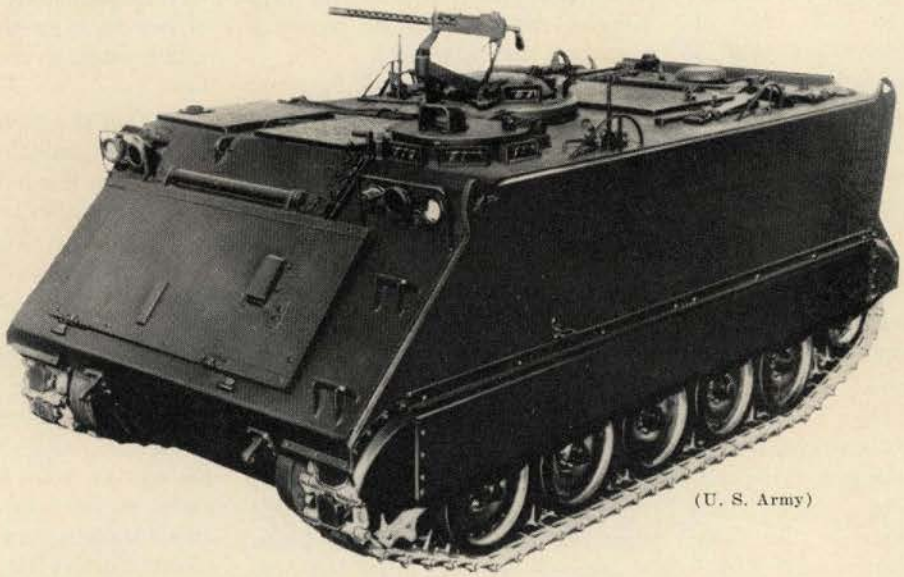
Within the Reconnaissance Troop changes include the reduction of tank crews from five to four men each and minor personnel adjustment. The Armored Cavalry Platoon continues to have an integrated arms structure of Scout and Tank Sections, Rifle and Support Squads. These and similar changes in the Armored Cavalry Squadrons of the Infantry and Armored Divisions will make all Reconnaissance Troops similar except for the type of radios authorized and the authority for substitution of medium gun for light gun tanks in the Armored Cavalry Regiment.

Summary

As can be seen the changes indicated in the revised Armored Cavalry Regiment do not alter the basic structure for reconnaissance. It is considered, however, that the capabilities of the Armored Cavalry Regiment have been increased. At full strength this organization will have the following capabilities:

1. Perform reconnaissance and provide security for the corps over wide fronts.
2. Engage in close combat for limited periods of time without reinforcement.
3. Maintain communications over wide areas and at extended distances from other units.
4. Rapidly exploit the success of nuclear weapons or other units.
5. Perform target acquisition and surveillance missions by air and ground reconnaissance.
6. Provide defense against airborne and guerrilla attack.
7. Protect rear areas and line of communications.
8. Control and coordinate substantial attachments of combat or combat support elements.

Revised training literature to reflect these increased capabilities is currently being prepared by the U. S. Army Armor School and should be issued early in 1960.



(U. S. Army)

The M113 Armored Personnel Carrier

THE M113 Armored Personnel Carrier is a light, full-tracked armored carrier designed for continuous cross-country operation, capable of:

1. Carrying a fully equipped Infantry squad.
2. Crossing inland waterways.
3. Air-transport and participating in Phase I airborne operations (parachute drop).

This carrier is designed to replace current Armored personnel carriers in Infantry, Armor and Artillery units. Eventually it will replace all M75 and M59 APCs. It will also serve where armor protection is required such as a personnel carrier, cargo carrier and transport vehicle for litter patients.

Its chassis components may be utilized in the design of carriers or self-propelled carriages for:

1. The 81mm and 4.2 inch Mortar.
2. The forward area antiaircraft weapon.
3. Various guided missile weapon and support systems.

The basic vehicle design with a modified superstructure will also serve as a mobile command post, fire direction center and communication center.

User tests are continuing at three CONARC locations: the U. S. Army Armor Board, the U. S. Army Infantry Board and the U. S. Army Arctic Test Board. Procurement of M113 APCs will be initiated in Fiscal Year 1959.

Performance

The vehicle is capable of more than 40 mph on level concrete roads. It has superior cross-country mobility and maneuverability to the M75 and M59 APCs, the vehicles it is replacing. The M113 crosses inland waterways utilizing its own power. Its cruising range on good roads, operating at an average speed of 25 mph, is more than 200 miles with on-vehicle fuel. It is also capable of towing a similar vehicle on improved roads. It can operate on a 60 percent longitudinal slope and a 30 percent side slope. It can cross over a trench 66 inches wide and negotiate a 24 inch verticle obstacle.

Power Train

The M113 APC is powered by the Chrysler 361B, which is a liquid cooled, carburetor, 90 degree V-8, spark ignition engine. It has a gross horsepower of 215 at 3,900 rpms.

The transmission is the Allison Model TX 200-2X. It contains a single stage, polyphase, with lock-up clutch, hydraulic converter. The controlled differential, transfer box and final drive are all of the Food Machinery and Chemical Corporation type.

Electrical System

The electrical system utilizes two 6TN 12-volt batteries. The alternator is 150 amperes and the igniter unit is

a waterproofed, shielded 24 volt system.

Communication System

Radio sets that can be installed in this new carrier are either:

1. The AN/GRC radio set 3, 4, 5, 6, 7 or 8.

An interphone system is provided for communication between the driver and the vehicle commander.

Miscellaneous

Towing lugs, lifting hooks and a swivel type pintle are all externally mounted for ease of handling.

A winterization kit can be installed for cold weather operations from minus 25 to minus 65 degrees Fahrenheit. Satisfactory operation without the kit is obtained from minus 25 to plus 115 degrees Fahrenheit.

Escape doors are provided as follows:

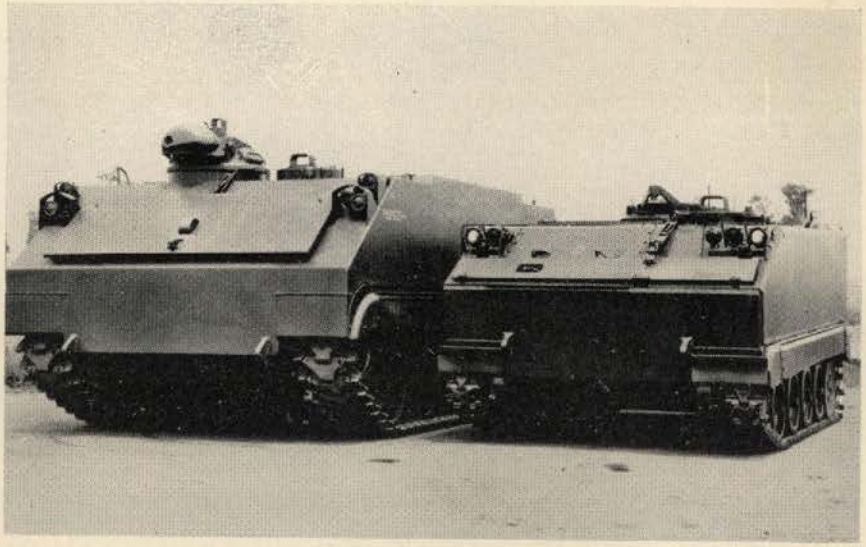
1. One rear roof door for personnel.
2. One commander's hatch.
3. One driver's hatch.
4. One rear ramp door.

Durability and Reliability

The durability and reliability of the M113 can be attested to by the requirements that it must be able to operate 2,000 miles cross-country with only organizational maintenance and 4,000 miles without replacing a major component or the necessity of a major overhaul. In addition to the requirement for quiet operation of the tracks they must have a minimum life of 3,000 miles. The M113 has a flat type suspension, i.e., the track return is on the road wheels; no support rollers are required. Tests have shown that this flat track suspension has less rolling resistance than tracks on former models of APCs and the M113 track life exceeds the 3,000 minimum required.

Summary

In summary, the M113 is a big improvement over its predecessors, the M75 and M59. Having a lower silhouette, capable of air transport and airdrop, increased cruising range and providing quieter operations all add up to these conclusions: We are increasing the ground mobility of our ground forces and are moving forward in our Army modernization program as advocated by our Chief of Staff.



Silhouette comparison of the M59 and M113. (U. S. Army)

THE M113 ARMORED PERSONNEL CARRIER

Crew	**1 man (driver)**
Personnel capacity	**12 men (including commander)**
Weight	
Combat Loaded	**22,163 lbs**
Air-drop	**18,200 lbs**
Design Gross	**24,000 lbs**
Length	
Overall	**189 inches**
Width	
Maximum overall (reducible to 100 inches)	**104.75 inches**
Height	
Maximum overall	**86.5 inches**
Air-drop	**85.5 inches**
Unit ground pressure	
Combat Weight	**7.2 psi**
Air-drop Weight	**5.8 psi**
Design Gross	**7.6 psi**
Armament (Primary)	
Machine Gun	**.50 Cal.**
or Machine Gun, Tank,	**7.62mm, T197**
Armament (Secondary)	
2 Rifles	**7.62mm, T14**
Engine	**Chrysler, 361B**
Transmission	**Allison TX 200-2X**
Fuel Capacity	**80 gal.**

Since the battalion scout platoon of the armored division is a relatively new organization and little material governing scouting methods is available, this article may serve to stimulate some thought on the subject and prompt others to develop concepts of their own of scouting operations.

WHICH METHOD?

By FIRST LIEUTENANT WILLIAM C. HAPONSKI

THE battalion scout platoon of the armored division is a fairly new organization, having been born with ROCAD in 1957. There exist in field manuals and training texts only brief outlines of the capabilities and methods of operation of the scout platoon. Consequently, scout platoons have had to learn almost entirely by experience the best methods of operation in accomplishing a given mission. Platoon leaders have had to develop their own reconnaissance formations and use the trial and error method in determining which ones are suitable for continued use.

Route reconnaissance is a common assignment for a scout platoon. In this article, four formations which can be used to accomplish the most common route reconnaissance mission, the reconnaissance of a single route, will be proposed for the reader's thoughts.

A route reconnaissance is conducted to gather all the information possible relative to a route, the road and bridge classes, obstacles and by-passes, condition of laterals, dominating terrain features, enemy positions and other pertinent information. The platoon formation selected to accomplish a route reconnaissance warrants a lot of consideration. In this article, emphasis will be given to the advantages and disadvantages of each of the proposed formations and the conditions under which each may be employed.

In order to better understand the reason for employing one formation in preference to another, a short outline of the platoon organization, a brief description of the employment of the squad, and a definition of critical terrain is necessary.

The basic scout element is the squad, consisting of a squad leader, assistant squad leader, two observers and two ¼-ton truck drivers. Both of the ¼-ton trucks in the squad mount a machine gun. For radio communication, the squad leader's vehicle is equipped with the vehicular AN/VRC-8 and the assistant squad leader carries the portable AN/PRC-8 in his vehicle. Two squads make a section with the section leader doubling as squad leader of the first squad. All of the three scout sections of the platoon are identical in organization and equipment.

The headquarters section consists of the platoon leader and platoon sergeant and their drivers, each element mounted in a ¼-ton truck with an AN/VRQ-1 radio capable of simultaneously operating in the battalion command net and the platoon net.

Thus, the platoon has three identical scout sections and a headquarters section. The total number of vehicles is 14 ¼-ton trucks, 12 of which mount machine guns. The platoon has more organic radios than any other similar size organization in the division—two VRQ-1's, six VRC-8's and seven PRC-8's (the platoon leader has one in addition to the portable in each squad).

The squad is the smallest scout unit capable of operating independently. With its two vehicles mounting machine guns, a vehicular radio and a

FIRST LIEUTENANT WILLIAM C. HAPONSKI, Armor, graduated from USMA in 1956. After attending the Basic and Airborne courses he was assigned to the 4th Armored Division. Gyroscoping with the Division he is now a Platoon Leader with Company B, 1st Medium Tank Battalion, 35th Armor in Germany.

portable radio, it possesses on a small scale all the capabilities of the scout platoon. It can use one element as a base of fire and the other as a maneuvering element when necessary. It habitually moves by bounds with one vehicle covering the advance of another. In short, it is the basic scout unit and should never be split into individual vehicles. (A night mounted patrol using one vehicle may be an exception.)

Critical terrain, as it pertains to the conduct of a route reconnaissance, is that terrain on or bordering the route which, when possessed by the enemy, allows him to observe and place direct fire on an element moving on the route. Critical terrain is almost always high ground. Scout platoon leaders must insist that lateral reconnaissance from the main route be pushed out at least as far as the critical flanking terrain in order to insure that the route is reasonably safe for movement.

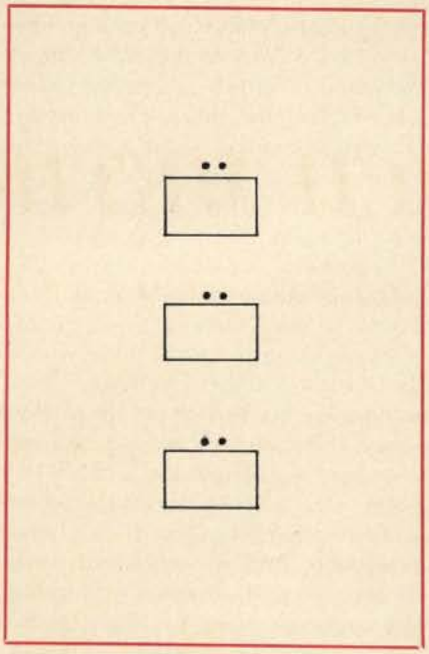
Two basic formations for route reconnaissance I have called the Road Runner and the Platoon V. Two others, the Platoon Y and the Roamer combine various aspects of the first two.

The Road Runner

The Road Runner concept calls for the employment of three sections, the lead, lateral and security sections, in that order, on the route to be reconnoitered.

The platoon advances on the route with the lead section reconnoitering visually and by fire the critical terrain features on and closely bordering the route. The mission of the lead section is to advance from one critical terrain feature to another, on, or very close to, the route and secure the movement of the remainder of the platoon by clearing and briefly occupying these terrain features. Since the enemy will normally have its defenses oriented on the main route, this section is usually the first to make enemy contact. When it makes contact, this section develops the situation. If the platoon is not allowed to bypass resistance, the lead section leader determines whether or not his section can handle the situation by itself. If so, the section attacks and clears the enemy position. If it is not capable of doing so, the lead section will establish a base of fire as the remainder of the platoon maneuvers against the position.

The lateral section moves in conjunction with the lead section, reconnoitering lateral routes immediately behind and in contact with the lead section. One squad is normally employed to reconnoiter to the left and the other to the right. The lateral reconnaissance is conducted to the first critical terrain feature on the lateral route. When the squads of the lateral section reach the critical flank terrain they pause to visually survey the terrain farther to the flank which is not visible from the main route. A measure of early warning of a flank threat is thus possible as long as the squads occupy this terrain. When satisfied with the visual inspection, the squads move back to the route and advance to the next lateral to be reconnoitered.



The Road Runner

Behind the lateral section, and not necessarily in contact with it, the security section has a dual mission, that of performing the actual route classification and overlay work with one squad while the other acts as rear security for the platoon.

There are several advantages to the Road Runner formation. This formation allows the greatest speed of reconnaissance of the four formations. Since all three sections are advancing primarily on the main route, movement across country and over poor parallel roads is kept to a minimum. The control and communication inherent in this formation is the best attainable. All three sections are operating from the main route and are concentrated for fast coordinated action. One section can easily pass through another to assume a different mission if circumstances dictate. This formation is the most flexible of any since any other type formation can quickly be attained from it. The close-in security offered by having all sections operate from a single route is the best of any of the formations. The immediate danger from small arms fire is minimized when all sections are working close together.

There are basically three disadvantages to this formation. An enemy farther out than the first critical terrain feature to the flank may be overlooked. Since the lateral section squads do not continuously occupy the critical flank terrain but instead return to the main route, enemy movement to the flank may go unnoticed. The dispersion of the platoon in the event of atomic attack is less than in any other formation. Admittedly, a scout platoon is not a likely atomic target but if a bomb does go off nearby, the platoon may suffer heavy casualties while using this formation. Finally, very little surprise can be obtained by advancing the entire platoon down the main route. Since the enemy's defenses and observation will normally be oriented on this route, this formation does not offer the prospects of surprise that some of the others do.

The advantages of the Road Runner formation then lie in its speed, control and communication aspects, flexibility and close-in security. Chief disadvantages are the lack of early warning to the flanks, lack of dispersion and loss of surprise. This formation will be used almost invariably at night and used when speed is so important that risks of flank attack must be taken.

The Platoon V

The Platoon V is the second of the two basic formations for route reconnaissance. In this concept, one section is employed on each flank ahead of the third section which advances on the route.

The mission of the section on the route is identical to that of the security section of the Road Runner. It performs the actual route and bridge classification and provides rear security for the platoon.

The flank sections have the mission of providing security to the flanks and front and accomplishing the lateral route reconnaissance. One squad of each flank section advances along the critical terrain flanking the route. This squad, moving by bounds, is virtually always in position to observe both the main route and the terrain farther to the flank not visible from the route. It is cautious to avoid skylining itself. Vehicle commanders and observers dismount frequently and move to positions where the maximum observation to the flank and front is possible. The other squad of the section reconnoiters the lateral routes and terrain between this extreme flank squad and the main route. As this squad nears the main route it halts briefly in a concealed position and thoroughly visually inspects as much of the main route and the dominating terrain bordering the route as can be seen. When the squad leader assures himself there is no activity to be seen, he moves to the main route and advances until he comes to the next lateral route on his side and then surveys back toward the extreme flank squad. Thus, a good measure of security to the front on the main route is also possible.

There are three notable advantages inherent in the use of this formation. It provides the best flank security of any one of the formations. Since one squad of each flank section advances on the critical flank terrain and maintains continuous observation while the other squad reconnoiters between the flanking terrain and the main route, good flank coverage is obtained. Secondly, a great measure of surprise can be achieved with this formation. The extreme flank squads often observe enemy activity without themselves being seen. Since the enemy orients on the main route, many times the squad which is doing the lateral reconnaissance between the extreme flank squad and the route will come up on the rear of an enemy position. Finally, the dispersion obtainable in this formation is the best of any.

This formation also has some notable shortcomings. The speed of operation obtainable is the slowest of any. With two sections advancing on the flanks, difficulties arise in traversing the terrain, many times across country. The rate of advance is dependent on the slowest element and, unlike when employing the Road Runner, it is difficult to pass one section through another or to switch section roles and missions to maintain momentum. This formation is likewise not as flexible as the others due to the dispersion of the sections and the difficulty of assembling them quickly. Control and communication are more difficult to obtain. Finally, there is less close-in security again, due to dispersion.

In spite of its disadvantages, this formation can be profitably employed. It may be used when occasional roadblocks exist on the main route which the platoon is allowed to bypass. Two sections on the flanks have already bypassed the roadblock and can be used to maneuver against the rear of the enemy position or to relay information as to existing bypasses. It is almost a certainty that enemy activity will be detected and pinpointed by using this formation whereas it might go unnoticed in using another. Although the rate of advance may be slow the coverage of terrain along the route is more thorough.

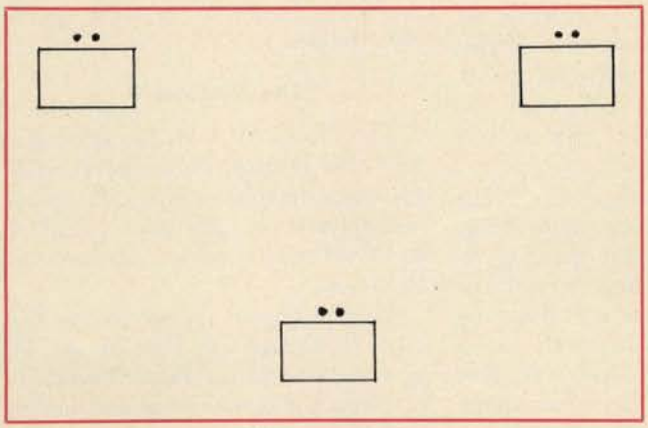
The Platoon Y

The third formation, the Platoon Y, combines characteristics of both the Road Runner and the Platoon V. In this formation, the main body of the platoon, consisting of two sections, advances on the route. It is preceded by two squads of the third section, one to each flank, advancing on the critical flanking terrain. This formation differs from the Platoon V in that only one squad is out on each flank instead of a section on each flank. The two sections on the main route are the lateral section and the security section.

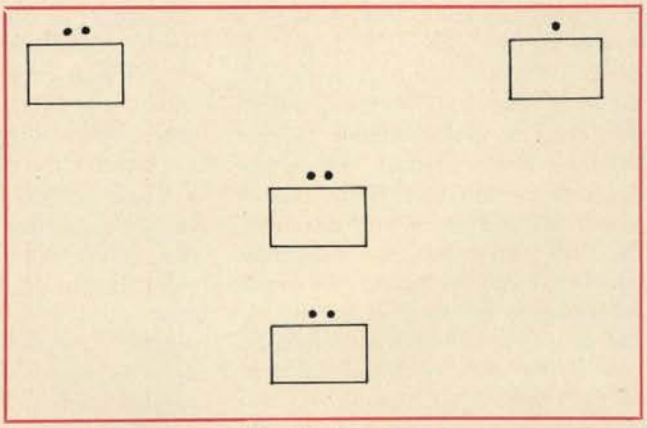
The mission and movement of each of the flank squads of this flank section is identical to that of the extreme flank squad in the Platoon V concept. They must provide the early warning of flank threat to the platoon. As in the V formation, these flank squads advance ahead of the main body and position themselves to observe both the main route and the terrain farther to the flank not visible from the route.

The mission of the lateral section is the same as in the Road Runner concept except that it does not maintain contact with the lead elements which are out on the flanks. This section employs one squad to reconnoiter laterals to the left and one to the right. Again, the reconnaissance is conducted as far as the first critical terrain feature to the flanks. This terrain should have been evacuated by the flanking squads as the flank squads advanced. Before returning to the main route, each squad pauses on this terrain for a visual observation of the area farther to the flank.

The security section's mission is identical to its mission in the employment of the other formations.



The Platoon V



The Platoon Y

Because the Platoon Y is a compromise between the Platoon V and Road Runner, it has some of the advantages and disadvantages of both. Neither the good nor the bad characteristics are as pronounced in this formation as they are in the Platoon V and the Road Runner, making this formation truly a compromise of the other two.

Better control and communication, greater flexibility and better close-in security are attained in the Platoon Y than in the Platoon V. This results from having two sections instead of the one of the Platoon V on the main route. Likewise, greater speed is attained than in using the Platoon V since only two squads instead of two sections are advancing on the flank terrain. Advantages over the Road Runner are due to having one squad leading on each flank, thus providing better early warning to the flanks, attaining greater dispersion and surprise.

This formation can be used effectively against roadblocks. Since two squads have already bypassed, the information they send is helpful in maneuvering against the covering force. At the same time, two sections are close by the main route, ready to be used to clear the block if necessary.

The Roamer

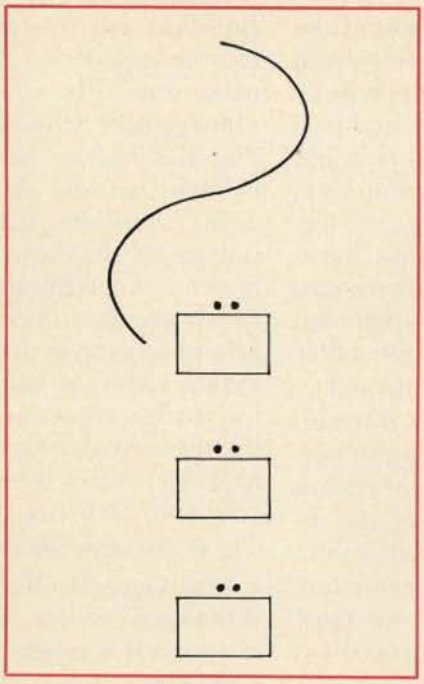
The last concept for conducting route reconnaissance is again a compromise of the characteristics of the two basic formations. It is also the most interesting and requires more initiative on the part of the section leader. This formation is called the Roamer.

After a careful map reconnaissance, the platoon advances along the route with the roamer section leading, usually on one of the flanks. The roamer section then roams back and forth across the main route well in advance of the lateral and security sections on the route.

The lateral and security sections have the same mission as in the Platoon Y formation.

The mission of the roamer section is to check particularly critical terrain which dominates the main route for enemy activity, attempting to come in from the side or rear to do so. The platoon leader and section leaders conduct a careful map reconnaissance prior to moving out to determine just which terrain will definitely dominate the main route. The platoon leader then selects only the most critical terrain which he desires the roamer section to check. Careful consideration is given to the roads, cover and concealment available. After the platoon designates which section is to be the roamer, the roamer section leader outlines his plan of movement for the information and coordination of all elements. He describes the routes he intends to take and his action on the objectives. The platoon leader approves or, if necessary, corrects the roamer section leader's plan.

On the move, the roamer section leader and his squad leader must exercise the utmost in initiative, command and control. The intent of the platoon



The Roamer

leader in picking this formation is to quickly conduct the route reconnaissance attaining a maximum of surprise. Hence, careful consideration of the routes actually taken must be given by the roamer section leader in order to advance rapidly and obtain cover and concealment. This section, in order to be fully effective, must be able to approach an enemy position undetected.

If this section has been able to come in on the flank or rear of an enemy on the objective, the platoon is in an excellent position either to bypass undetected or to attack.

If the platoon is allowed to bypass enemy positions, the roamer section leader supplies the platoon leader with the necessary bypass information. The whole platoon may then bypass the position undetected.

In case the platoon is not allowed to bypass enemy positions and if the roamer section finds only a weak position which the section itself can handle, it will quickly attack from its position on the flank or in the rear, overrun and continue the mission. If the platoon leader decides to attack with the entire platoon, the roamer section establishes a blocking position to fire in the enemy's rear or flank and cut his withdrawal routes as the remainder of the platoon assaults the position.

Since the roamer section is not bound to any particular locality or route as is much the case in the other formations and since it must check out only the most critical terrain, it has time to exercise a lot of caution and stealth and to approach the objectives from the flank or rear unobserved, a marked advantage. The speed, control and communication, flexibility and close-in security attainable in using this formation are almost as good as in using the Road Runner. This is due to having two sections on the main route and the third concentrated and under the close control of the section leader. Dispersion and early warning to the flanks are comparable to that which the Platoon Y offers.

This formation can be profitably used when surprise and speed are particularly desirable. There must exist, however, fairly good lateral and parallel roads to allow the rapid movement of the roamer section.

It cannot be definitely stated that one formation should be used in preference to another in any given instance. It might very well be that the platoon functions best by using only one formation. However, the advantages to be gained by being capable of employing different formations as situations change cannot be overlooked. In the two basic formations, the Road Runner and the Platoon V, both the advantages and disadvantages are very pronounced. The Platoon Y and the Roamer concepts are more moderate, employing characteristics of both the basic formations. The formation which allows the platoon leader to fully accomplish his mission the fastest is the one he will employ.

Editorial

The practice of good management in the Army becomes increasingly important as we revamp our organizations, concepts, training and thinking to keep abreast of our new weapons and equipment while we prepare for an emergency in the nuclear age. In fact, the increased costs in items of equipment for conventional war alone demand that we employ nothing but the best in management practices in order to stay within our budget. Adding to this the cost of missile systems, electronic devices and other innovations, each and every commander is faced with the hard realization that he must get nothing but the best results; yet he must use the most economical approach.

This is not new with the Department of the Army but we feel it demands repeating from time to time in the hope that someone will be made cognizant of his responsibility and perhaps take a second look at his own operation, and come up with some definite improvements. This is not limited to business practices as they apply to logistics, the technical services, manpower and personnel management, financial functions and the Army Command Management System. It encompasses every Army endeavor in which we are engaged.

Within the combat unit it applies to training, housekeeping, maintenance, supply, personnel practices, combat and everything which we endeavor to do to prepare the individual soldier for combat and maintain him while he is fulfilling this, his primary mission. It is this ultimate goal for which we must employ every good management procedure.

As stated earlier, this is not new within the Army. The Army has recognized this problem for many years. In fact, during World War II, as early as 1943, there was a board established to control the utilization of manpower. It was named "The War Department Manpower Board." Its function was to scrutinize the utilization of manpower by the Service, Ground and Air Forces. Since that time we in the Army have tried to insure that we accomplish our mission with the minimum number of personnel.

Recognizing this problem and its importance in peacetime as well as during hostilities, the Honorable Karl L. Bendetsen, then Assistant Secretary of the Army for General Management, made the statement that the commander is the true manager of the Army, and that a vehicle of management instruction for commanders was needed in the Army School System. This was the birth of our senior Army management school which is located at Fort Belvoir, Virginia. The U. S. Army Command Management School first opened its doors in the Fall of 1954, becoming an integral part of the Army School System. Patterned after the Advanced Management Program offered to industrial executives at the Graduate School of Business Administration at Harvard University, it presented a three-week course in management instruction. Its primary area of interest was the management of Army installations and activities.

In the Spring of 1958 an evaluation board endorsed the operations of the School but recommended two major changes. First, the name should be changed to the U. S. Army Management School. This was due to the fact that the former name led many people to believe that the school was primarily concerned with the teaching of technical procedures of the Army Command Management System. Actually there is a connection between the institution and the system but the School objectives are much broader than providing technical instruction. The second major change recommended that in addition to the three-week course, a shorter five and one-half day course be included for general officers and civilians of comparable seniority. These changes became effective in 1958.

One General Officer, upon completing the three-week course, stated that "I wish I had attended this course when I was a line officer. I sure would have been a better company commander, battalion commander and would have accomplished every assignment I have held more efficiently." It occurs to this editor that perhaps the practices of good management must be instilled in our junior officers as well as our senior and general officers. True, the knowledge the senior officers receive while they attend this course will be put into practice on their next assignment. But will this information which is so valuable permeate down to the junior and noncommissioned officers? It is quite doubtful.

How can combat unit commanders utilize good management practices? Many units of all components practice good sound management procedures. But it is a continuing, never-ending process. Some of these practices have been reported in the pages of *ARMOR*. In

fact, in this issue two such noteworthy items where maintenance time is saved are reported. In addition, there is a saving in manpower; yet the results are more efficient than obtained by previous methods. (See pages 52 and 56.) These items were published in the hope that other units would profit by these innovations.

Let's see how the tactical commander can institute better management procedures at his level.

One aspect of good management is in the supervision of a good, sound training program. Recently in a speech at the Army Management School, General Bruce C. Clarke, CG, USCONARC, stated:

> There is no endeavor in the Army more important than good training management which avoids waste of training time of the soldiers. Since the cost of each training hour is about five dollars per man, training time is one of the Army's highest priced commodities and most valuable possessions.

What soldiers learn in training they will do in combat. If tank crews loaf during training exercises, they will be lackadaisical in combat. This is not saying that we do not give them rest breaks. But during halts on motor marches, maintenance must be performed. During tactical exercises when some troops are not engaged in the actual problem, we must utilize this time to prepare range cards, run through battle drills and dry-run firing problems so that when the time comes to actually use these skills they are automatic.

Training time is precious and we, as commanders, must see that we give the soldier the maximum. At the time the individual might not appreciate it. Should the occasion arise where enemy fire is being returned, he will appreciate the fact that he was well prepared.

With the ever-increasing drain on our manpower availability, we must utilize the personnel we have to the best of our ability.

If a housekeeping job can be done with two men, do not send a platoon and thus have time and manpower wasted. Conversely, let's not send the proverbial "boy" on a man's errand. Analyze the job and utilize an adequate number of men to accomplish it with the most economical means, in time, money and man-hours.

In the assignment of personnel, let us use our trained personnel in the proper job. If an enlisted man is trained as a mechanic, let him be a mechanic, not a radio operator or a cook. Take advantage of the skill and talent of the individual; otherwise we are not going to receive the maximum benefit from our troops. Also, the individual will be happier and do a better job if he is accomplishing that which he is best equipped to do. His morale will be high and you, the commander, will benefit by obtaining better results.

In other words get the "square peg in the square hole" and demand the maximum effort.

Many of us have seen where thousands of dollars have been saved through better supply procedures in depots and other technical service installations. Recognition to various individuals who have made such suggestions has been given in the form of cash awards.

There are also savings that can be made at small unit level by instituting proper supply methods. The tactical commander must constantly check to assure himself that there is no waste of property. Also, he must constantly check to insure that it is properly maintained. This not only applies to the large and expensive items; it applies to each and every pair of shoes. It likewise applies to the expendable items which are issued, to assure that there is no excess waste.

Each saving regardless of size reflects proper management and in turn better leadership.

The Department of the Army has maintained a continuing interest in good management practices within the Army. The graduate of the Army Management School must impart what knowledge he gains to his subordinates. This should be accomplished by the commander in his daily chores in dealing with his units. He also is responsible for assuring himself that proper management procedures are being practiced down to and including his squad leader, his tank commander and the lowest echelon which he commands.

Much recognition has been given at higher echelons for suggestions and savings. Recognition must be given even at small unit level; and corrective action must be taken where malpractices are observed.

All of our methods of administration must be streamlined to keep pace with the times.

Good administration, good supply and maintenance procedures and good training methods all add up to *good management* which in turn means *good leadership.*

(U. S. Army)

Let's Make The Tank Crew Pentomic

By CAPTAIN NORBERT BRANDON

THE word *pentomic* brings forth visions of streamlined and efficient combined-arms teams, ranging in size from division to platoon. This is the result of years of study and preparation. However, the reorganization has stopped short of that basic fighting element, the tank crew. Should we be satisfied with the tank crew as it looks today? Are we using our tankers to the fullest extent of their ability? Let's take a look.

CAPTAIN NORBERT BRANDON, Armor, served in the Pacific during World War II with the 11th Airborne Division. He was commissioned from OCS in 1951. A frequent contributor to ARMOR he recently completed a tour of duty in Korea and is enroute to his new assignment at the U. S. Army Armor Center, Fort Knox, Kentucky.

Today, *The forgotten man of Armor* is the tank loader. In the days of the M47, and the other tanks which were blessed with five-man crews, there was some choice as to which man became the loader, after the tank commander, the gunner and the driver had been selected. Since the advent of the M48 and M41 tanks with their four-man crews, there seems to be no choice at all.

Why should we concern ourselves with this lowest-ranking man in the tank? At the risk of stirring up a hornet's nest, I believe that the loader should not only outrank the driver, but must take precedence over the gunner as the number two man of the crew.

Every tanker learns to drive the tank early in his career, regardless of what his subsequent job might be. To become a professional driver requires little additional training, consisting mainly of practice. The driver, more so than the other crew members, is in effect only a physical extension of the tank commander's will. Rarely, if ever, will he move the vehicle without direct instructions.

Each neophyte tanker also learns to fire the tank gun. Admittedly, this requires more technical training and a keen judgment of distances, terrain and enemy targets, both moving and stationary. Nevertheless, the gunner, as a result of the advances made in fire-control and sighting equipment, is rapidly becoming an unnecessary appendage, mainly because everything

Are we utilizing the full capacities of each member in the tank crew? In this day of atomic plenty, but with a shortage of trained personnel, we must demand the maximum effort from each member: The commander, driver, gunner and loader.

he does can be done just as well by the tank commander, if the need arises. It is true that the gun control switches and the computer might be a little difficult to reach from the tank commander's position. Since this would not be difficult to correct, the gunner's reasons for existence are fast fading. Already there is talk of reducing tank crews to three men. The design of satisfactory automatic loaders has not progressed to a point where we can expect their production in the near future, while the dual fire-control system is already an accomplished fact. Even today, if an M48 crew for some reason were short a man, the gunner's seat would be vacant, should the vehicle have to enter combat.

Now let us take a look at the tank loader, human variety, both as he is today and what he might be, when fully utilized. It is customary to assign the lowest-ranking men, and those considered to be of "limited ability," as loaders in our tanks. To compound the felony, the training of loaders in their appointed jobs is virtually nonexistent, mainly because this requires live ammunition and it would be unrealistic to use dummy rounds which will not let the gun recoil and eject. But the loader has many other jobs, which include: The stowage of some six different types of 90mm gun ammunition; thousands of rounds of caliber .30 and caliber .50 machine gun ammunition; the proper maintenance of the ammunition and its placement in the racks for rapid availability, consistent with the type of combat to be expected; the maintenance and adjustment of the coaxial caliber .30 machine gun, its loading and the reduction of stoppages; and the setting-up and non-technical maintenance of the tank's various radios and the intercom system. How many loaders have been seen lately who can set up a tank radio for operation, and who report to the tank commander somewhat like this:

> Set number one, red flag on platoon frequency, green flag on company frequency; Auxiliary receiver, flag "A" on company frequency; Set number two, on the supporting infantry frequency. Everything is ready to go!

This question is not intended to be facetious, but I feel that it points up a serious gap in training which must be closed if our tank crews are to hold their own in the face of enemy numerical superiority. The average loader today, a PFC or Sp3, simply is not up to this part of his job.

There are two other duties, not presently required, which the loader can, and should, carry out. The first is to act as another pair of eyes for the tank commander during times when no actual firing is in progress. In movement to contact, the loader, all weapons loaded and the radio operating properly, should be looking out of his hatch, observing the terrain in search of the enemy or watching the unit leader for visual signals. This 100 percent increase in observation will pay off in superior control for the unit commander and in a reduction of losses from surprise enemy fire. Once combat begins, the loader reverts to feeding the guns and swapping radio channels for the tank commander. If he is good, he might even answer a call on the number two set when the tank commander is busy on the number one set.

The second duty involves taking command of the tank in the event that the tank commander becomes disabled or is killed in his hatch. Who is in the best physical position to assume command? Who has observation of the situation and can take *immediate* action? The loader, of course. Imagine the gunner trying to take over the tank commander's position with latter's body slumped so that the gunner is jammed into his seat. Someone must make a quick decision to protect the tank and to keep it in action, if possible. The loader is the logical man to do this. He has communication, both in the tank and with his unit, and has quick access to the radio. He can give excellent fire commands from his hatch, even without a rangefinder, until the pressure is off. And he can still load, although much less rapidly. Most important, the tank remains a fighting vehicle, instead of becoming merely a sitting duck for some enemy pot-shot.

Does all this mean that we should suddenly reduce all gunners and promote the loaders in their place? Not at all. I do suggest that we start training our present loaders in becoming expert gunners, *now*. Then, when the unit next goes into the field for live firing in platoon and company problems, have the ex-loader do the shooting while the ex-gunner in effect becomes a combination loader-radioman-observer, ready to take command, if required.

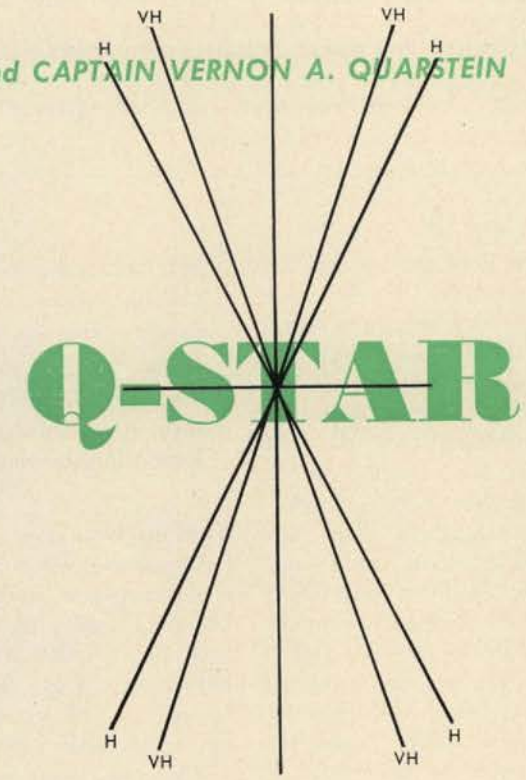
By the time a man acquires the stripes currently authorized for a gunner, he accumulates a great deal of assorted knowledge about tanks, which is not limited to the gunnery phase, but includes the entire vehicle, its operation and maintenance. Why then place him into a job which makes use only of a fraction of his training and ability? The possible argument that the physical labor of loading debases his rank does not hold water when countered by the importance of the other duties which this man must perform with competence and confidence.

Now is the time to re-evaluate the organization of our tank crews. At a time when every other branch is screaming for more than its share of high-IQ soldiers, it is obvious that we must use our available talent to the maximum advantage. This can be done by placing the most able man into the most important job. On the tank, next to the tank commander, the loader-radioman-observer will be that most important man.

Armor has a reputation for advanced thinking. The changes suggested here will further increase the combat potential of all our armored units, at no cost whatever.

We may not have the most tanks, but let's make the most of the tanks we have!

By MAJOR DONN A. STARRY and CAPTAIN VERNON A. QUARSTEIN



A Qualitative System of Target Analysis for Nuclear Weapons Employment

In the November-December 1958 issue of ARMOR, *we published an article concerning our Army missile family. In it we posed many questions as to the proper employment of missiles. We asked about our own troop safety. We were concerned as to how we would determine the proper weapon to be used and the proper yield to destroy our target. Many of these questions are answered in this excellent article. There still remains, however, the initial problem of target acquisition. In the immediate battle area this can be solved. But we must develop a means of reaching deep into enemy territory to get the maximum benefit out of the missile systems we are now developing.*

THROUGH the hot humid hours of a dusty August afternoon the 23d U. S. Armored Division lies in wait behind the barrier of the Blue River for Aggressor to attack. To the front the Division Cavalry Squadron flirts with the enemy, probing—feinting—dashing to fill a gap—falling back with deliberate calculated movements on succeeding delaying positions.

The Division mission is to destroy Aggressor!

Like thin fingers of signal smoke, the dust trails of Aggressor armored columns thread skyward as his lead units close on the river line. Crossings are sought. In open areas along the river, enemy armored personnel carriers begin to swim through the swift current; preconstructed ferries are quickly launched and begin to cross with tanks aboard; bridging is run rapidly down to the river. A crossing in full force is in progress.

From ambush the 23d Armored Division tanks launch a hail of fire at Aggressor as he crosses. Rafts and ferries are sunk midstream, carriers are swamped and disappear beneath the rushing waters. The momentum of the advance brings greater numbers of armored vehicles and equipment down to the bank.

Momentarily the Aggressor commander has massed at crossing sites along the river.

Aloft, and almost unnoticed during the course of this action, a light aircraft, bearing the insignia of the 23d Armored Division, soars gull-like through the crystal-blue afternoon sky. In the observer's seat a Lieutenant Colonel listens to his radio—watches closely as Aggressor gathers on the river. As the Aggressor tanks mass behind the crossing sites the observer glances at a set of simple looking charts laid across his lap—makes a brief check with an acetate scale—a few marks with his grease pencil. A call on the radio—a word of warning—the command to fire.

In the forest behind the river a howitzer crew dashes to positions—a breech clangs shut—an arm falls in command and ten thousand tons of death whirr into the August sky. Some distance away a giant rocket belches eerie flames—lurches up the launching rail and with sudden determined purpose bores skyward.

The air above Aggressor is rent with a sudden clap of thunder—the mushroom of doom blossoms over the crossing site. A multiple pattern of myriad colored clouds appears in swift succession.

Within minutes an entire Aggressor tank division lies impotent along the river.

You are witness to the swift application of massed nuclear fires on a momentary, fleeting target. The secret?

The secret lies in the presence of the observer and his trusty grease pencil aloft—with authority to fire—equipped with Q–STAR—a qualitative system of target analysis for the employment of nuclear weapons.

What Is Q—Star

Q–STAR is a complete, qualitative system for the analysis of targets for nuclear attack. It is based on:

1. A high (91%) or very high (98%) assurance of achieving the desired height of burst with any fuzing system.
2. A high (94% or better) assurance of accomplishing the desired degree of damage or casualty production on a given target.
3. A complete four-step graphical system for selection of proper weapons, accurate burst heights, and correct delivery means to attack any target.

Tools for Q—Star

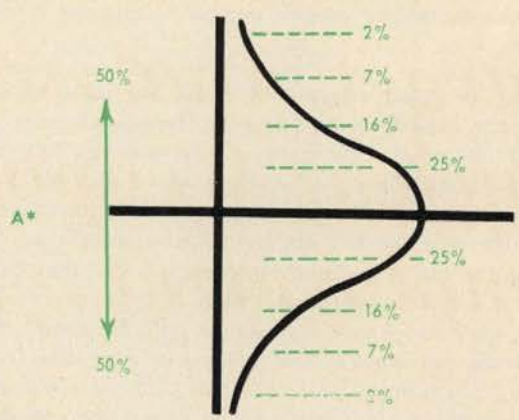
In Q–STAR each element of the target analysis is expressed graphically. The heart of the system is a graphical device called the Height of Burst Selector.

The Height of Burst Selector

The Height of Burst Selector is designed to express along a vertical scale in meters:

1. The height of burst.
2. The assurance (or probability) of achieving the desired burst height based on the fuzing error of the weapon employed.

Q–STAR standardizes assurance (or probability) for a desired burst height at *high* (91%) and *very high* (98%) because these percentages are associated with 2 probable errors and 3 probable errors respectively. For example, we know that at the desired height of burst (H_b), half of all rounds fired will detonate *below* and half *above* the exact burst height, for example—burst point A. A graphical representation of this fact related to the normal probability curve would look like this:



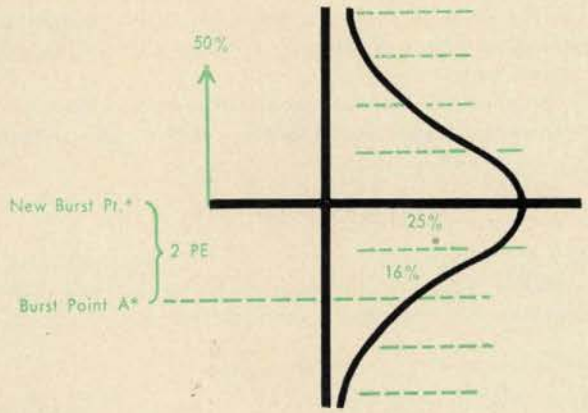
No. 1

We also know that if we raise the height of burst to a point 2 probable errors in fuzing above burst point A, the probability that a single round will burst above point A is 91% (50% above the new burst point plus 41% of

MAJOR DONN A. STARRY, Armor, a 1948 USMA graduate, has served with the 1st Infantry Division in Europe, as Aide to the Commanding General, 3d Armored Division, and on the Eighth U. S. Army staff in Korea. A graduate of the Nuclear Weapons Employment Officer Course at C&GSC, he is presently an instructor in Armor subjects and nuclear weapons at The U. S. Army Intelligence School, Fort Holabird, Maryland.

CAPTAIN VERNON A. QUARSTEIN, Infantry, a 1950 USMA graduate, has served with the 1st Infantry Division in Europe, the 2d Infantry Division at Fort Lewis, Washington, and the 7th Infanry Division in Korea. A graduate of the Nuclear Weapons Employment Officer Course at C&GSC, he is an instructor at The U. S. Army Intelligence School at Fort Holabird, Maryland where he instructs in infantry subjects and nuclear weapons.

the bottom half of the probability curve which has now been displaced 2 probable errors upward). Graphically:



No. 2

This we define as a high assurance (91%).

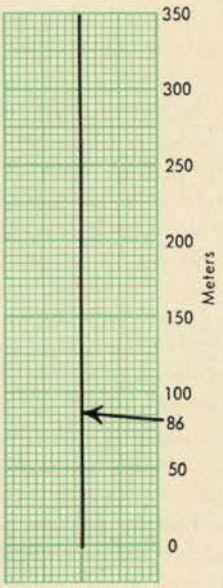
Similarly, if we raise the height of burst to a point 3 probable errors above the original burst point we have a 98% assurance that the weapon will burst above burst point A. This we define as a very high assurance (98%).

Two fundamental considerations govern the selection of a height of burst:

1. When it is desired that there be no danger of fallout, we must assure ourselves that the fireball will not touch the ground. For when the fireball contacts the ground the earth that is vaporized and cast upward falls to earth many miles away, as radioactive fallout.
2. There must also be a reasonable assurance that the weapon will detonate in a burst height range where it will accomplish the desired degree of damage to the target.

Since the lower heights of burst are most effective against the battlefield type targets (tanks, weapons, personnel in armor or in foxholes), we are not only concerned with minimum heights of burst (to insure against fallout) but with limiting the *upper* extremity of the burst height so that the weapon will not by chance detonate too high to affect the target to the desired degree. In other words, to give a complete assurance, high (91%) or very high (98%), we must be not only 2 or 3 probable errors *above* a minimum (to avoid fallout), but 2 or 3 probable errors *below* a maximum as well (to insure adequate damage). Obviously, the probabilities can be varied from those expressed here very simply. The values 91% and 98% which we have defined here as high and very high assurances respectively are felt to be reasonable and in the interests of standardization have been selected as minimum acceptable values.

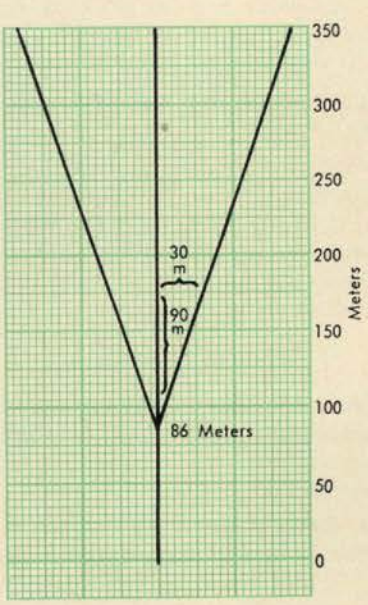
To portray this discussion graphically, Q–STAR uses a Height of Burst Selector. On a vertical height of burst scale graduated in meters, select a fallout safe burst height (height of burst above which the fireball will not touch the ground) for a given weapon. Suppose for example we are using a 20-KT weapon and tabular data gives the fallout safe burst height as 86 meters. We can locate this point on the graphical scale. If there were no errors in the fuzing system, our problem would be solved.



No. 3

Unfortunately the problem is compounded by the fact that there is a probability of error in fuzing. Assume that the fuzing error of this same 20-KT weapon is 30 meters. This means that 1 probable error (PE) equals 30 meters and that 25% of the rounds will burst within this distance *above*, and 25% within this distance *below* the desired burst point. To insure that 98% of these weapons will burst above the desired 86 meters height of burst, we could simply burst the weapon at a point 3 PE's above 86 meters (86 + 3(30))=176 meters.

A much simpler system is to construct on our vertical meter scale, using 86 meters as a point of origin, lines which slope outward from the vertical at a ratio of 3 to 1. In other words, for every 3 units we move *up* the vertical scale, the line slopes outward 1 unit. If we ascend the vertical scale to a point where the perpendicular distance out to our sloped line is 30 meters, we are automatically 3 x 30 or 90 meters above the original burst height of 86 meters.

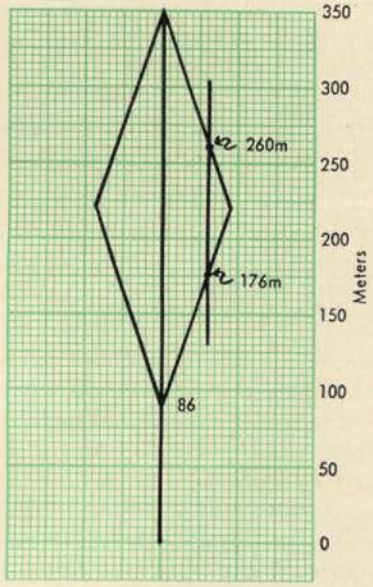


No. 4

The problem solved mathematically a moment ago we can now solve graphically and read directly a height of burst of 176 meters.

Now, let us suppose that at heights of burst above 350 meters this 20-KT weapon is no longer effective against the battlefield type targets. We must then assure ourselves that the burst height will be *below* 350 meters by a sufficient distance to provide the required assurance (98%). From a point on the vertical scale where the height of burst equals 350 meters we construct lines at a slope of 3 to 1 as before, in a *downward* direction.

This tells us, as before, that for a very high assurance the weapon will not detonate *above* 350 meters, we must burst the weapon below a distance of 350—3(30)=260 meters. We have a burst height range then between 176 and 260 meters. Graphically this can be expressed by scribing a line parallel to and 30 meters away from the vertical index of the Height of Burst Selector. The intersection of this line with the outward sloping lines describes the height of burst limits above which and below which *this* weapon with *this* fuzing error must detonate to meet the conditions stated.

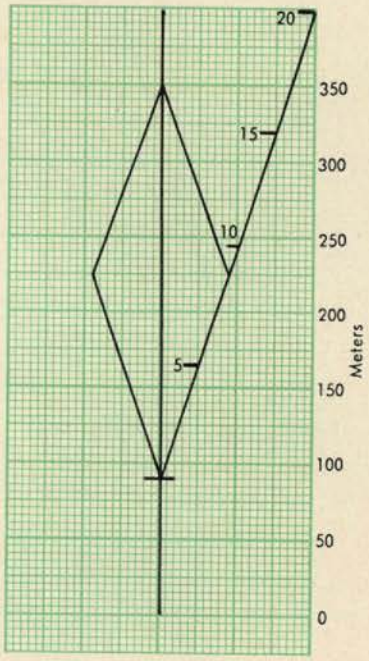


No. 5

The same process can be followed to establish any desired assurance (probability) by varying the slope of the lines and for any weapon with any fixed probable error in fuzing.

In some cases we find that the fuzing error of the weapon varies with the range to the target. In this instance we calculate the error at any convenient range to the target, express this range and errors at all deliverable ranges on a kilometer scale along one of the outward sloping lines.

If our 20-KT weapon has an error that is determined for example by dividing the range by 200, and the maximum range of the delivery means under examination is 20 kilometers, the error at this range is 20,000/200=100 meters. This means that at maximum range the probable error in fuzing is 100 meters. Locate this point 100 meters on a convenient sloped line representing high or very high assurance and label it 20 km. A similar process for other ranges will develop a full scale for the entire range of the weapon. The probable error/range variation may also fluctuate with variations in charge, launcher, rocket motor and other operational conditions. It should be normal practice to obtain this information from the delivery unit and apply it to the construction of a range scale. For training and planning purposes, however, it is more convenient to construct, as described, a representative scale.



No. 6

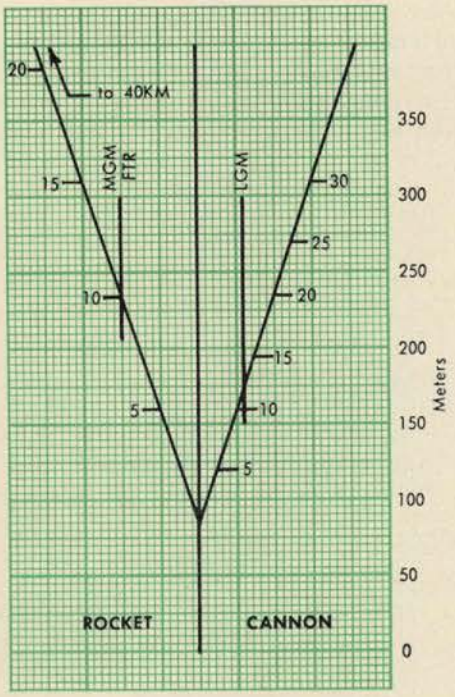
Using the selector calibrated as above then, we can visually examine the height of burst selections available at various ranges for a very high assurance. Note that this weapon with the fuzing error assumed cannot be fired at ranges beyond 9 kilometers with a very high assurance of getting the desired burst height. For at burst heights which are fallout safe beyond that range, 3 probable errors upward causes the weapon to detonate *above* the maximum effective height of 350 meters.

With the Height of Burst Selector fully completed then, we can calculate immediately the height of burst limits *and* range limits for any degree of assurance that the desired height of burst will be *above* the fallout safe height and *below* the upper limits at which damage falls to unacceptable levels. A single Height of Burst selector then can be constructed for *each* yield available, calibrating it to reflect height of burst limits for all available weapons fuzing systems and delivery means.

For our 20-KT weapon for example, the delivery capability might be represented as follows:

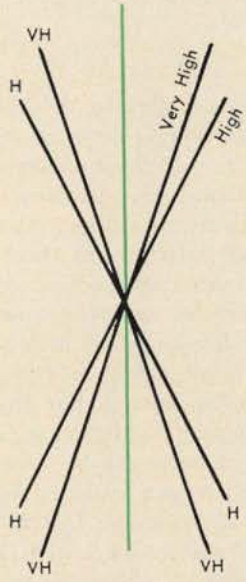
Weapon & Yield	Delivery means	PE H_b	Max Range
Foxtrot 20-KT	Long range cannon (LRC)	Range/400	30 km
	Large free rocket (LFR)	Range/200	40 km
	Light guided missile (LGM)	30 meters	50 km
	Med. guided missile (MGM)	50 meters	150 km
	Fighter aircraft (FTR)	50 meters	800 km

The Height of Burst Selector for this yield would look like this:



No. 7

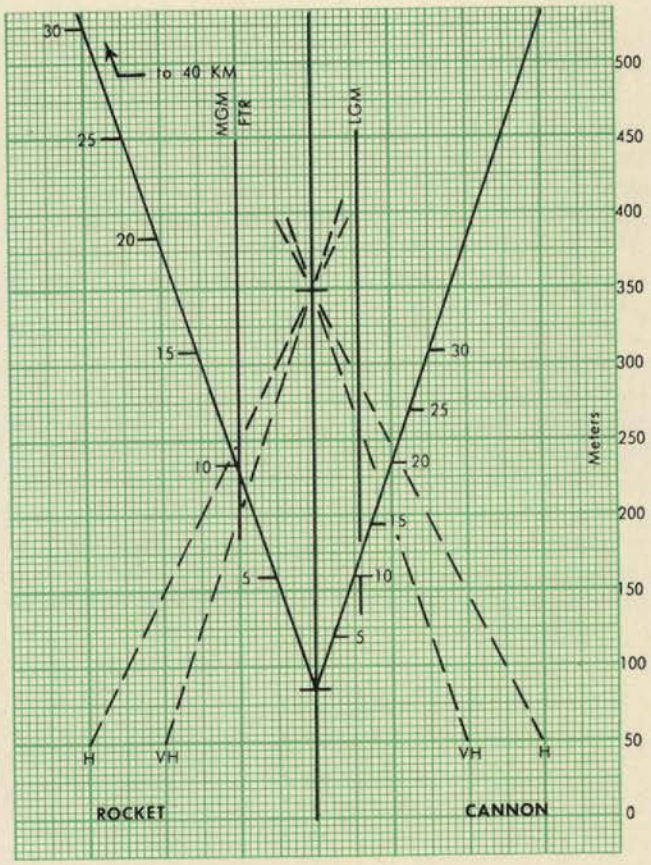
For convenience in the completed Selector, we remove the upper portion of the Selector and place it on a piece of acetate.



No. 8

The vertical line is an index. The other lines slope at 3 to 1 and 2 to 1 respectively to give us visual representation of high and very high assurance.

Now, by moving the acetate vertically along the Height of Burst Selector index line we can express the probability limits for a variety of weapons effects. Let us call this device a *probability indicator*. *Example:* If the damage to tanks and artillery pieces from this weapon falls below acceptable levels at heights of burst above 350 meters, we place the center of the acetate probability indicator at 350 meters on the vertical index of the Height of Burst Selector and we have a graphical representation of the upper and lower limits of burst heights and their associated degrees of assurance.



No. 9

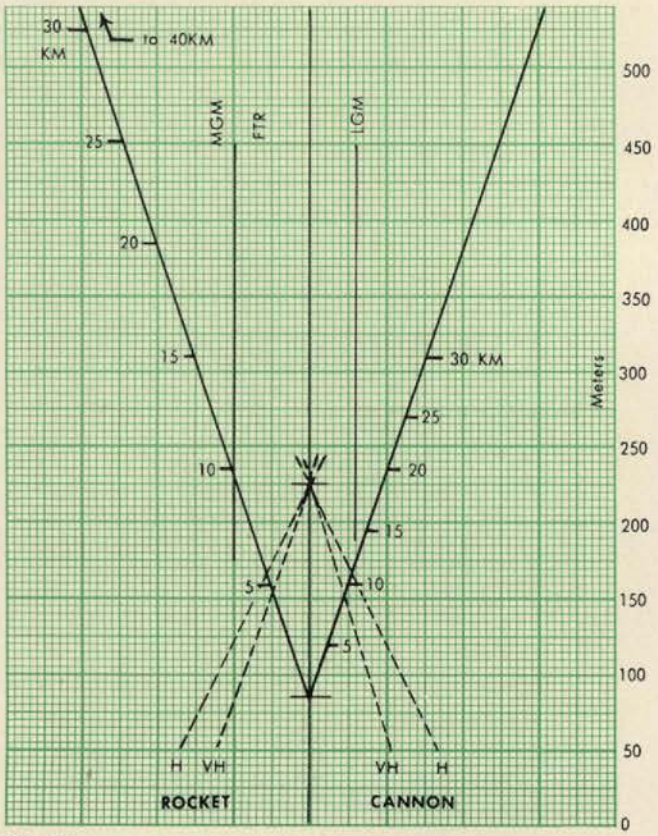
Examining each delivery means in turn then, the Height of Burst Selector tells us graphically:

1. The long range cannon can deliver this weapon at ranges up to 17 kilometers with a very high assurance, and up to 21 kilometers with a high assurance of getting the desired burst height. At lesser ranges there is a variety of possibilities for height of burst. At 5 kilometers for example, the height of burst can be between 120 meters and 310 meters with a very high assurance of getting any burst height between those limits. For we can read directly that at 5 kilometers range 3 probable errors above a fallout safe height of burst is at 120 meters, while 3 probable errors below 350 meters is at 310 meters.

2. The large free rocket can deliver this weapon up to 9 kilometers with a very high assurance, and up to 11 kilometers with a high assurance of getting the desired burst height. As before, there is a wider range of available heights of burst at lesser ranges.

3. Now consider delivery means with a fixed probable error in burst height. The light guided missile delivered weapon can be fired with a very high assurance of heights of burst from 175-260 meters. The medium guided missile and fighter delivered weapons can be fired with a *high* assurance of heights of burst from 230-245 meters. The medium guided missile and fighter delivered weapons *cannot* be fired with a very high assurance since the fallout safe burst height plus 3 PE's is read at 225 meters. A *very high* assurance of not exceeding 350 meters brings the height of burst down to 215 meters—or *below* the fallout safe burst height.

Example: The target is a bridge or small cluster of similar targets. Suppose that for our 20-KT weapon, severe damage to bridges falls to an unacceptable level at burst heights above 225 meters.



No. 10

First we relocate our acetate probability indicator as shown above so that its center lies at 225 meters on the height of burst scale. Each delivery means can again be examined in turn:

1. The long range cannon can deliver this weapon at ranges up to 9 kilometers with a very high assurance, and 11 kilometers with a high assurance of being above 86 meters, and below 225 meters in burst height. Again, at lesser ranges a wider variety of burst height selections is available.

2. The large free rocket can deliver the weapon up to ranges of 4.5 and 5.8 kilometers respectively with an associated very high and high assurance.

3. Considering the delivery means with fixed fuzing errors, the fighter and medium guided missile *cannot* deliver the weapon with the desired assurance of the required height of burst. The light guided missile can deliver the weapon with a high assurance only.

Thus has Q–STAR provided positive assurance of achieving a required height of burst.

The association of the Height of Burst Selector with other elements of Q–STAR will be developed in illustrative problems to follow.

The Horizontal Error Indicator

Thus far we have dealt with vertical errors only (errors in fuzing).

The second element of Q–STAR is a graphical device to provide visual representation of the *horizontal* delivery errors associated with every weapon and delivery system available for a single yield.

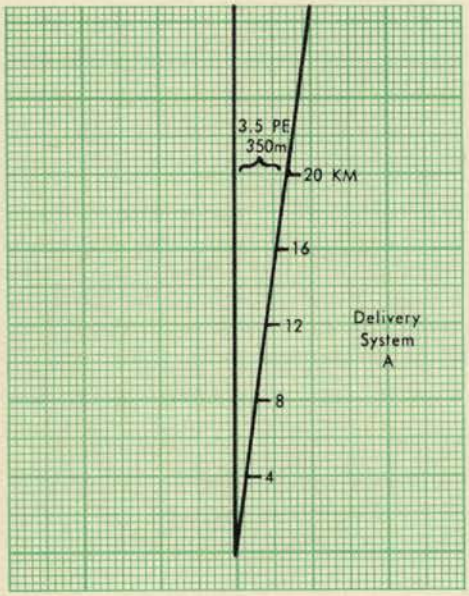
We are again concerned with fixed errors and errors which vary with the range from the delivery site to the target. An additional problem presents itself in that, for certain systems, horizontal errors are expressed as probable errors (PE) when the dispersion pattern is elliptical, and for others as circular errors probable (CEP) when the dispersion pattern is circular. There is also the possibility that, for certain delivery systems, the probable error in deflection may exceed the probable error in range. Consideration must also be given to an expression of sufficient probability values (related to a number of delivery errors) to give a high or very high assurance that the target will be adequately covered.

Q–STAR combines all these elements in a convenient device which expresses 3.5 probable errors and 2 CEP. Q–STAR standardizes probabilities as shown on the chart below. These values represent probabilities of 94-99% in safety, depending on the orientation of friendly troops, and at least 94% in damage.

Starting with a center line scaled in meters we construct from an origin point a line that slopes outward to a distance equal to 2 CEP or 3.5 PE at maximum range for the delivery system with the largest error. Suppose imaginary delivery system A has a PE of 100 meters at a maximum range of 20 kilometers. At a point on the outward sloped line where the horizontal distance from center line is 3.5(100)=350 meters indicate a maximum range of 20 kilometers. Then on this line, which we shall

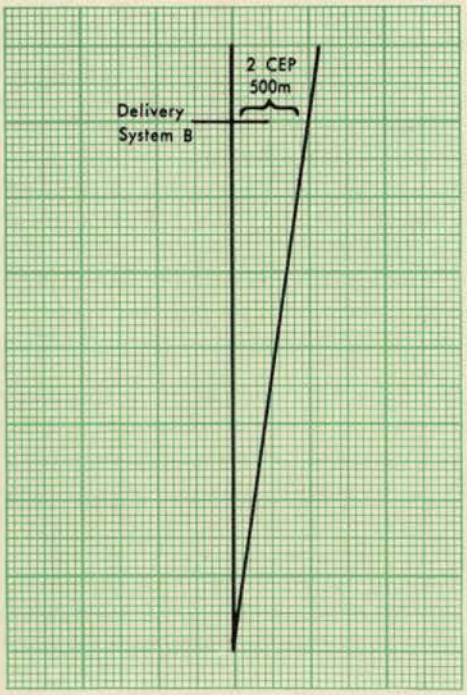
Height of Burst		Safety				Damage	
Number of PE's Vertical	Probability %	Number of PE's Horizontal error	Probability % Type Troop Disposition			Probability %	Number of CEP's Horizontal Error
			Linear	Semi-Circular	Circular		
2	91	3.5	99	97	94	94	2 CEP
3	98						

call the delivery system A index, construct a kilometer scale which reflects 3.5 PE at each range. The size of the diagram will be influenced by the scale. It is more convenient to express the values on the Horizontal Error Indicator to a given map scale. Here is the indicator described above to a scale of 1/50,000:



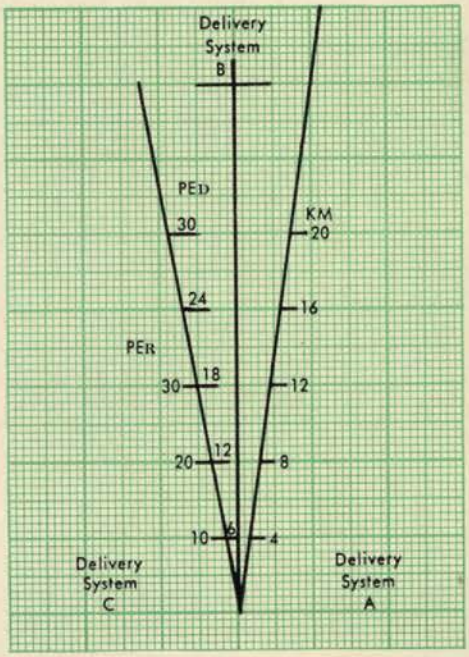
No. 11

An imaginary delivery system B has a horizontal error which does not vary with range. Add to the diagram a scribe line along the center line where the distance from its intersection with the center line to the delivery system A index represents 2 CEP for delivery system B. Suppose that delivery system B has a CEP of 250 meters, 2 CEP=2(250)=500 meters. Again to a scale of 1/50,000 this is represented:



No. 12

Further, assume delivery system C, which has a deflection probable error which exceeds the range probable error. As before, we shall represent these errors (which vary with range) along a line sloped outward from the center line. The errors for the desired assurance 3.5 (PE) in range (PE_R) are portrayed along the outer side of the index for delivery system C, the errors in deflection (PE_D) along the inner side of the same line. The completed Horizontal Error Indicator then looks like this.

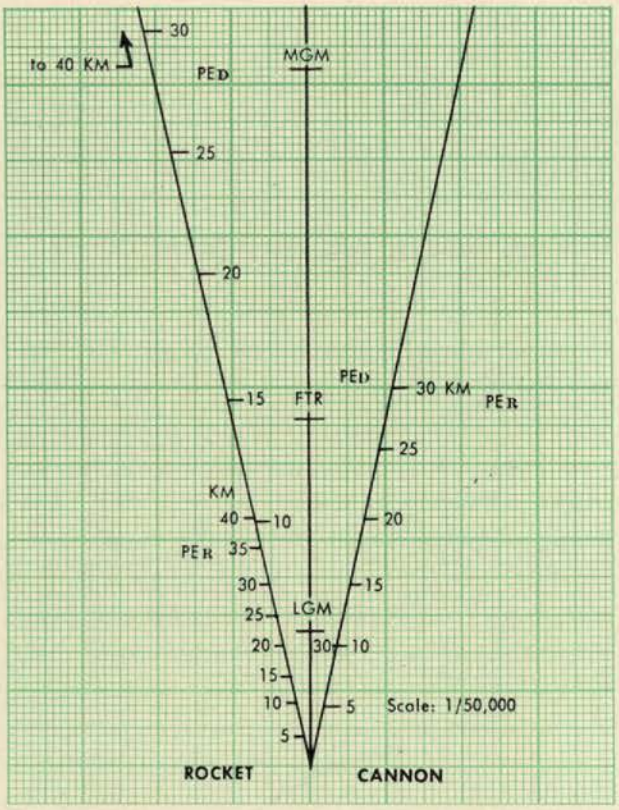


No. 13

If delivery systems for our 20-KT weapon have the following characteristics:

Weapon/Yield	Delivery means	Horizontal Errors: Range PE_R	Horizontal Errors: Deflection PE_D	Horizontal Errors: CEP	Max Range
Foxtrot 20-KT	Long range cannon	Range/200	Range/600		30 km
	Large free rocket	Range/400	Range/100		40 km
	Light guided missile			100 m	100 km
	Med. guided missile			500 m	500 km
	Fighter aircraft			250 m	800 km

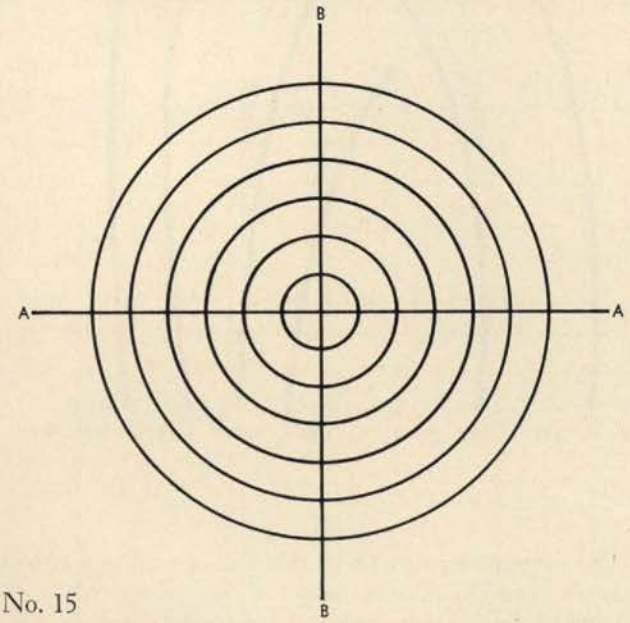
A completed Horizontal Error Indicator would look like this:



No. 14

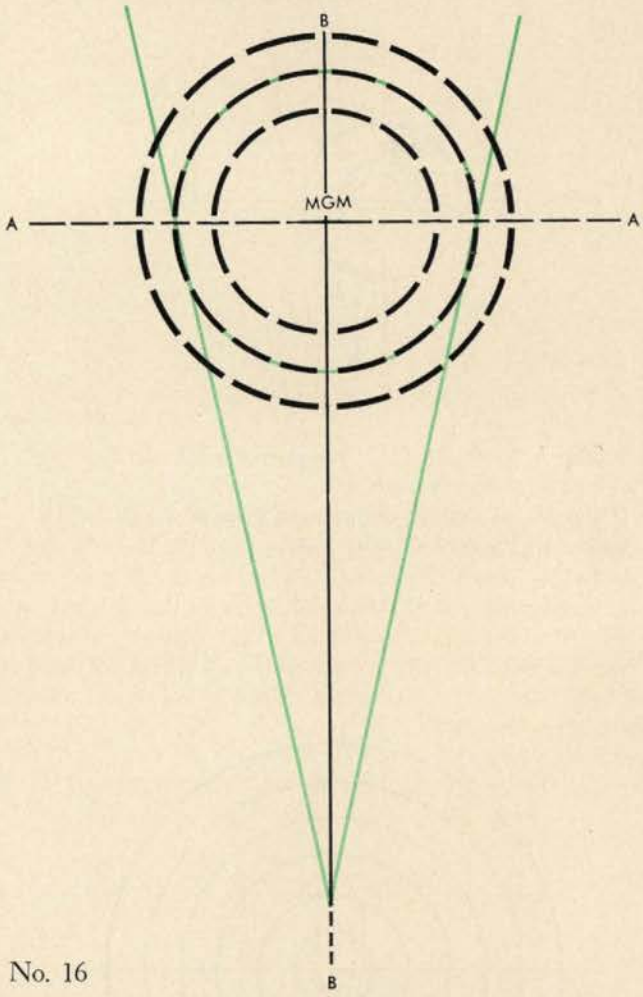
As was the case with the Height of Burst Selector, the probable error or CEP *vs.* range relationship may fluctuate with various charges and rocket/launcher combinations. Again this information should be supplied by the delivery unit and applied to the construction of a range scale calibrated as discussed here.

Maximum effective utilization of the Horizontal Error



No. 15

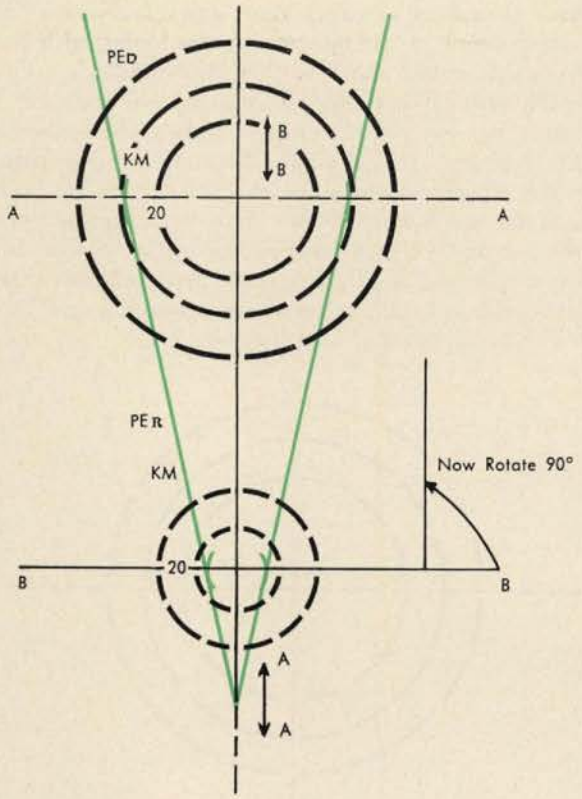
Indicator can be accomplished by using it in conjunction with acetate and grease pencil. If we utilize a circular distance scale on acetate, as shown below, we can scribe with a grease pencil circles which represent 2 CEP or 3.5 PE by simply laying the acetate on the Horizontal Error Indicator so that either axis, but B-B for example, coincides with the center line of the Horizontal Error Indicator. If we place the center of the circular scale at the scribe line which represents 2 CEP for the Medium Guided Missile then the distance—Center line to 2 CEP line—can be indicated and a convenient circle drawn with grease pencil on the acetate. We then have on the acetate scale a circle which represents 2 CEP, or a circle inside of which 94% of all rounds will fall, or in which a single round has a 94% chance of landing. Graphically:



No. 16

The same procedure will establish a circle of 3.5 PE in radius at any range to the target. When the deflection and range probable errors for a delivery system are different we can establish an accurate picture of the *exact* dispersion pattern by letting axis B-B represent the gun/launcher to target line. Mark the range probable error (3.5 PE) from the center of the scale along B-B. Rotate the acetate through 90° and express the deflection error (3.5 PE) along axis A-A. An ellipse can now be drawn on the acetate using these limits, representing the exact horizontal dispersion pattern (3.5 PE in range and 3.5 PE in deflection) for a very high assurance that the round will fall within these limits.

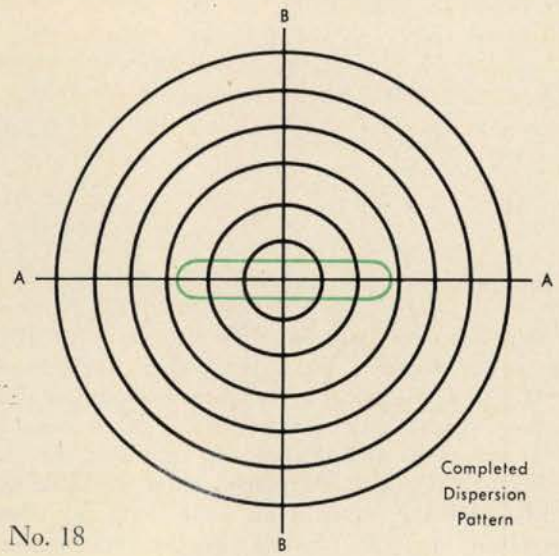
If we assume a range to the target of 20 km and utilize the Horizontal Error Indicator for our previous 20-KT weapon the procedure outlined above looks graphically like this:



Step 1: Mark 3.5 PE in range along B-B.
Step 2: Rotate acetate 90°
Step 3: At top of diagram now mark the 3.5 PE in deflection distance on axis A-A.

No. 17

Now with grease pencil complete the dispersion pattern.



No. 18

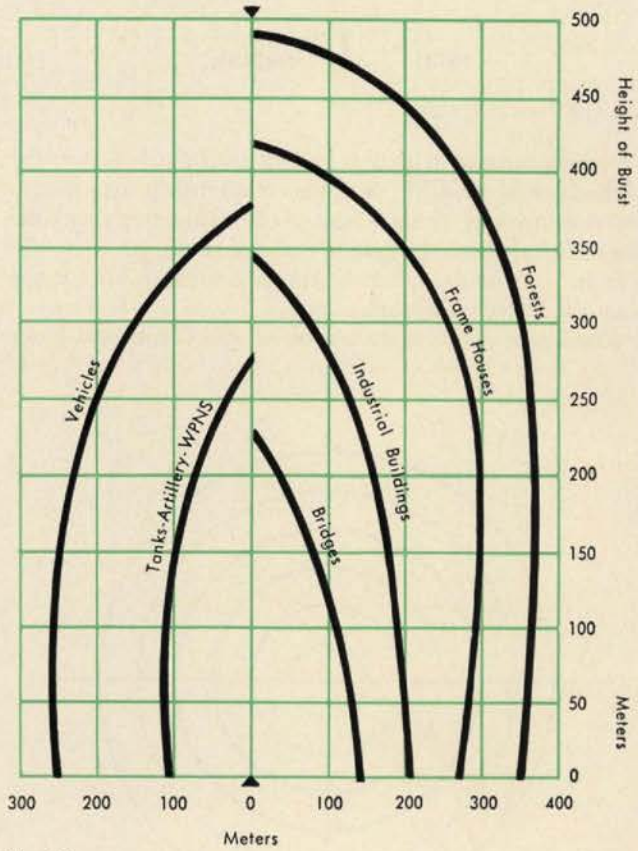
Here we have indicated a delivery system in which the probable error in deflection exceeds the probable error in range. A similar process would develop a like elliptical pattern for systems whose range error exceeds the deflection error.

Now by marking with a grease pencil on the acetate a circle whose radius represents the damage or casualty radius for a given target element we can visualize to what extent the weapons effects will be thrown off target by the maximum delivery error in any direction. Where troop safety is a consideration, we can represent safety radii as arcs at the required distance from the origin of our acetate scale and visualize then the danger to friendly troops at maximum delivery error.

Just as we initially provided positive control of the burst height range with a high or very high assurance, we have now provided positive expression of horizontal errors with 99% assurance for safety, 94% for damage.

Damage/Casualty and Troop Safety Curves

The third element of Q–STAR is a graphical representation of damage, casualty and troop safety curves. Damage and casualty radii, as well as safety radii for various conditions of risk and warning are expressed horizontally along a convenient scale outward from an index line. Usually it is most convenient to establish the radii representation on a common map scale so that the distances in question can be read directly from the horizontal scale, transferred to acetate and applied directly to a map. The effects curves are also tabulated against a vertical scale which represents the associated height of burst for a given radius of effect. The completed picture then represents effects for common targets at all burst heights. Graphically:



No. 19

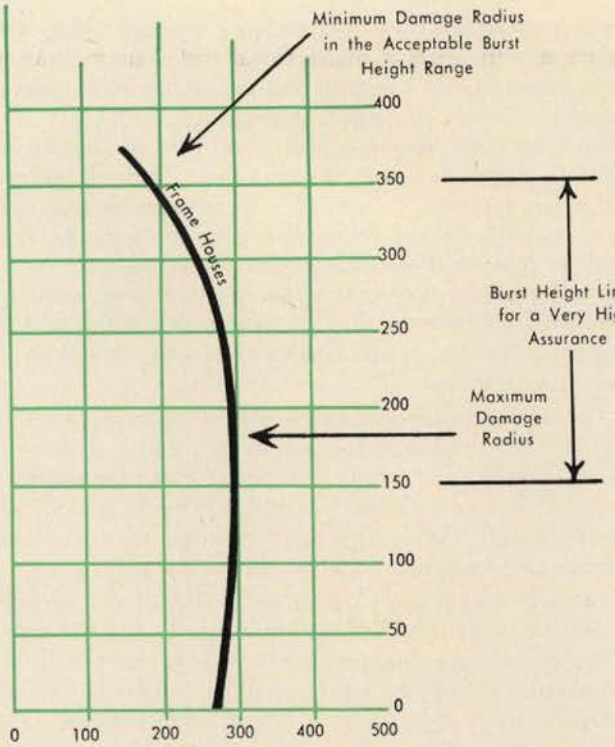
The diagram above tells us that damage to bridges for example commences at a radius of 125 meters for zero heights of burst, then falls off gradually until at 225 meters we reach a cut-off point. Above a burst height of 225 meters then, there is no longer damage to bridges. Damage to forests on the other hand begins at a radius

of 350 meters for zero height of burst, increases to a maximum radius of about 360 meters at a height of burst of 200 meters, then decreases until above 490 meters height of burst there is no longer damage to forests.

Obviously any convenient combination of curves for any selected array of targets is appropriate. Q–STAR standardizes the relationships involved by expressing damage and obstacle radii on a single index, casualty radii on another series of indices designed to express the full range of casualty effects and safety conditions. The completed family of curves then portrays first, the radius of damage, casualties or safety, and secondly the variation in these radii with the height of burst of the weapon.

As in our earlier discussion the expression of a desired height of burst is compounded by the fuzing error of the weapon. We developed the Height of Burst Selector to graphically resolve this problem. The probability consideration in height of burst can be extended one further step now and applied also to a damage radius. For example, suppose we establish, using the Height of Burst Selector, that we must have a burst height between 150 and 350 meters to insure that a given weapon will not produce fallout but will produce an acceptable radius of damage to a target—say to frame houses. Recalling our previous discussion, we will then have a very high assurance that the weapon will detonate within those height of burst limits. Transfer this assurance to the damage radius. Examine the damage radius for frame houses. Note that it curves outward between 150 and 350 meters in height of burst to a maximum value of 300 meters. To obtain this radius of damage (300 meters), however, we would have to burst the weapon at exactly 200 meters in burst height. (See chart No. 20.)

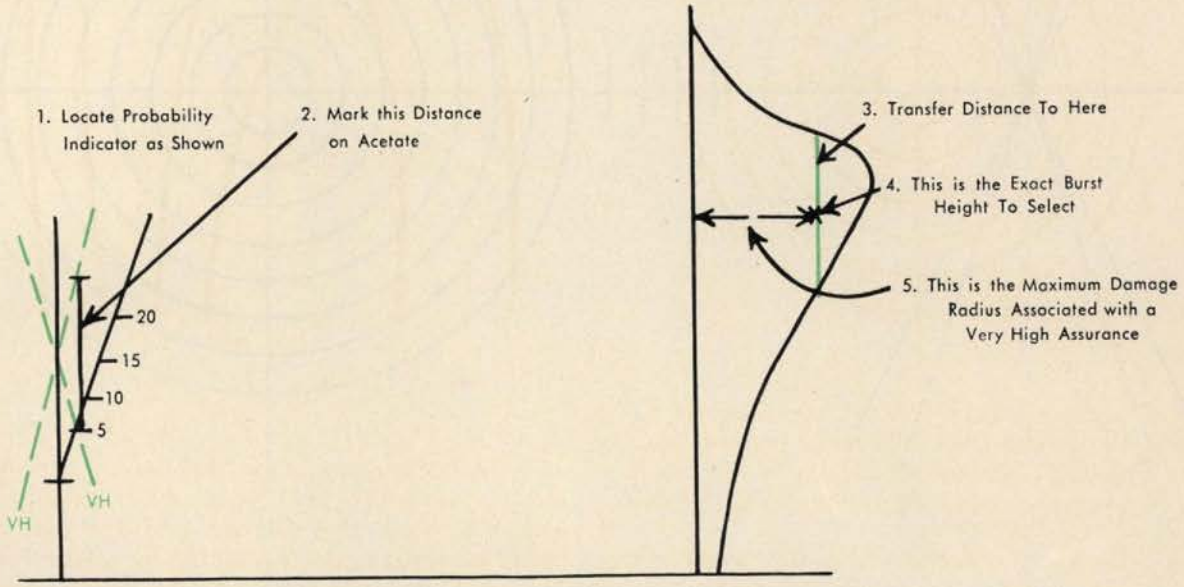
In reality then, we cannot assure ourselves of much better than a fifty-fifty chance that 200 meters will be the actual burst height and 300 meters the actual damage radius. To be quite realistic we should use the *minimum* damage radius in this burst height range which is, in this case, 200 meters radius of damage at a height of burst of 350 meters. Now we can say that we have a very high assurance not only of getting the desired height of burst but we can



No. 20

associate this assurance with the radius of damage as well. So the effects radii as expressed can be used in conjunction with the Height of Burst Selector to give us a very high assurance in height of burst and damage/casualty/safety radii within that burst height range.

This technique is most applicable when the effects curves increase to greater values as the height of burst increases. First, as before, we insure the burst is fallout safe. Then we mark with grease pencil on the probability indicator two points, one on the very high assurance line, 3 PE above (for the delivery system under investigation) and one 3 PE *below* the center point. Assume a cannon delivered weapon at 5 kilometers range.



No. 21

Now transfer this measured distance upward along the effects curve until the ends of the transferred distance line (maintained in a vertical position) intersect the curve above and below the point of maximum radius on the curve. The burst height is read directly at the center of the transferred line and the minimum damage radius within the transferred distance is the *maximum* that can be associated with the required degree of assurance. For what we have in effect done is determine the exact burst height based on the knowledge that the weapon may detonate 3 PE above and 3 PE below that point, and a maximum damage radius that can be associated with a very high assurance.

The simplest method for rapid visualization of all these problems is to combine the acetate probability indicator for use with the Height of Burst Selector *and* the circular acetate scale used with the Horizontal Error Indicator and the effects radii. On a single sheet of acetate then we have a device that looks like the chart shown below.

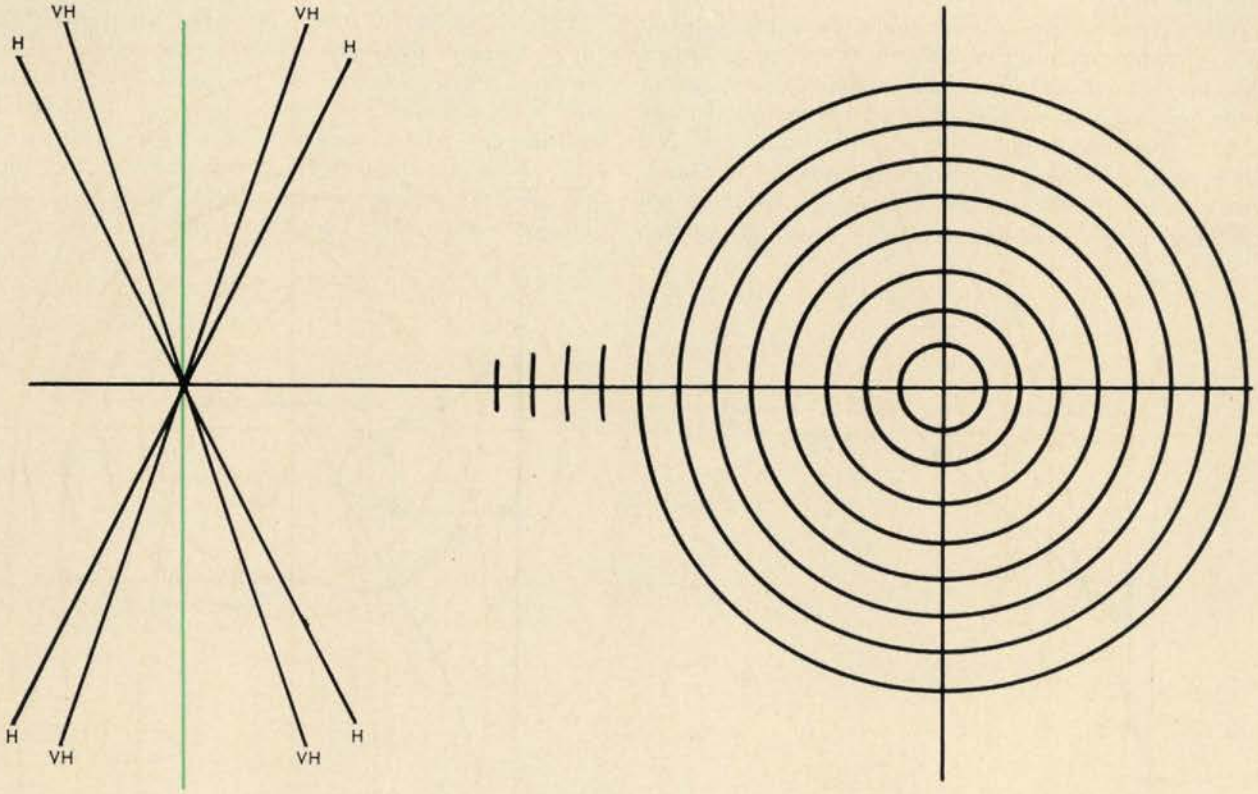
To make this device, which we shall call the *acetate reader*, most useful no scale is indicated. To use the scale with a given map, simply indicate with grease pencil on the acetate the distance represented by each circle for the particular map scale in use. The distances in the Q–STAR charts can be altered then without changing the charts themselves. For example, the circles in the illustration are each 250 meters apart for a scale of 1/50,000, but for a 1/100,000 scale they represent 500 meters, for 1/25,000 they are 125 meters each, and so on.

To provide immediate visualization of the effects of Height of Burst on the effects radii, we simply place the Height of Burst Selector on a vertical scale identical with the vertical scale of the effects curves. The distances between indices is the distance between the vertical indices on our acetate reader.

Now if we place the acetate reader over the combined Height of Burst Selector and damage curves diagrams, we can proceed to the solution of a problem.

Suppose we are firing at our frame houses once more, now with a cannon delivered weapon at a range of 10 kilometers. We want a very high assurance (98%) of no fallout, and very high assurance of getting the maximum possible damage radius. Consider for the moment that there is no horizontal delivery error. Our analysis is accomplished in the following manner.

Step 1: Align the acetate reader so that the index of the probability indicator coincides with the vertical index of the Height of Burst Selector, and the vertical index of the circular scale coincides with the vertical index of the effects curves.



No. 22

This device should be copied on acetate using a sharp instrument to scribe the lines. The lines can then be filled in with soft lead.

Step 2: Move the acetate up the index of the Height of Burst Selector until the very high assurance line intersects the 10 kilometer range mark on the index for the cannon delivery means. At this time our situation looks like the chart shown at the bottom of this page.

Broken lines indicate acetate reader in proper position.

Step 3: Since the effects radius does not increase above the point located, we read the radius directly as indicated. This represents the maximum radius of effect that can be expected with a very high assurance. The height of burst is read directly as 165 meters, the damage radius as 290 meters, or transcribed to the acetate with a grease pencil to enable graphical visualization of the effects on the target represented on a map or overlay.

We have now selected a height of burst that allows a very high assurance that we will achieve at least the effects radius expressed on the circular scale, and is fallout safe.

Let us briefly review the elements of Q–STAR which we have now described.

First, we developed the *Height of Burst Selector* which is designed to present graphically the burst height ranges within which we have a desired assurance of a weapons detonation based on the fuzing error of the weapon in question. A single Height of Burst Selector for each available yield can depict all weapons and delivery systems associated with those weapons.

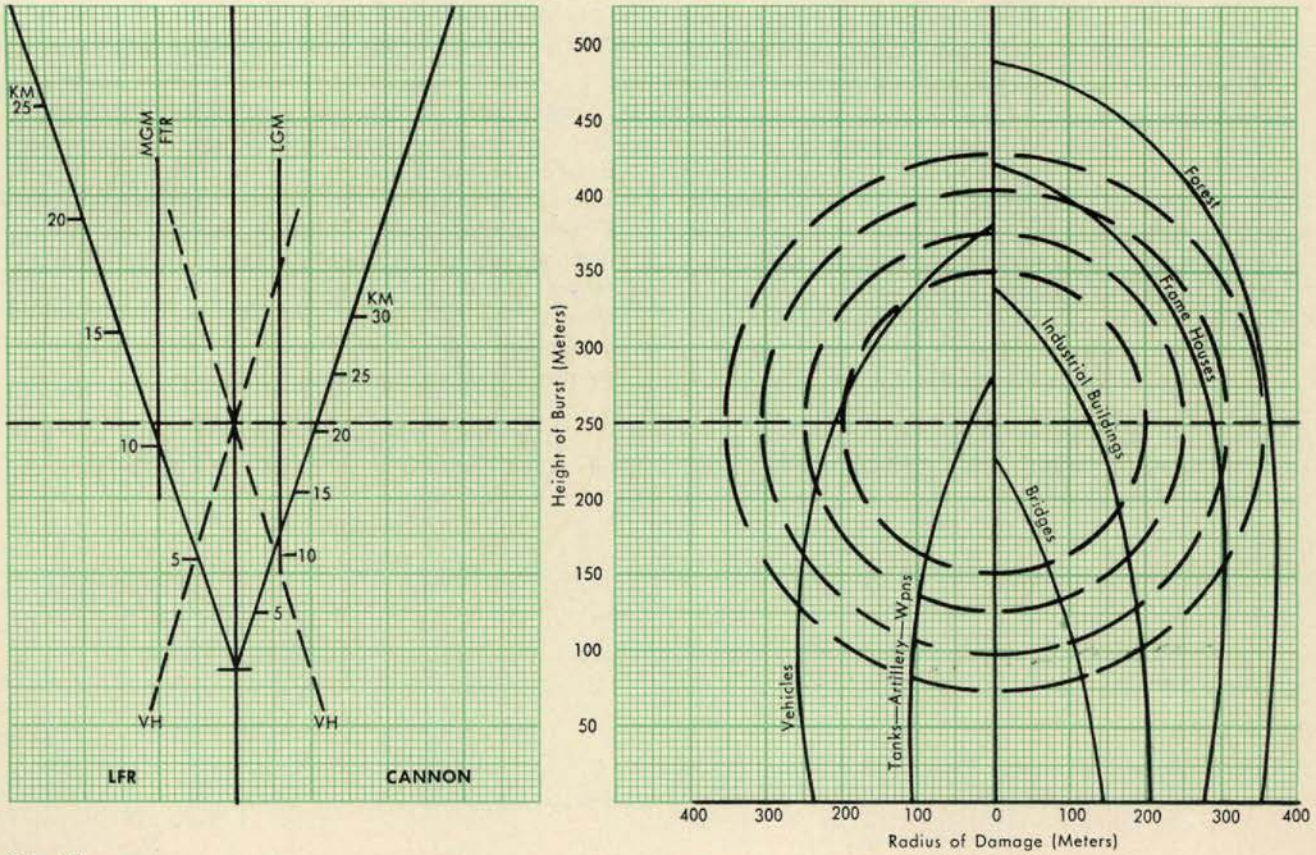
Second, we described our horizontal delivery errors by means of the *Horizontal Error Indicator* which graphically depicts 2 CEP or 3.5 PE for all delivery means associated with a particular yield. This assures of 99% probability for safety, and 94% probability for damage.

Third, we expressed effects radii graphically in a series of *Damage-Casualty-Safety Curves* which portray for a single yield the variation in weapons effects with the height of burst of the weapon.

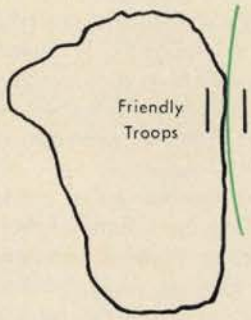
Finally, we combined the use of the Height of Burst Selector and the Damage-Casualty-Safety Curves using the *Acetate Reader* (probability indicator plus circular map scale) which allowed us to visualize not only the height of burst assurance but the assurance associated with a selected effects radius.

All these elements are combined as follows:

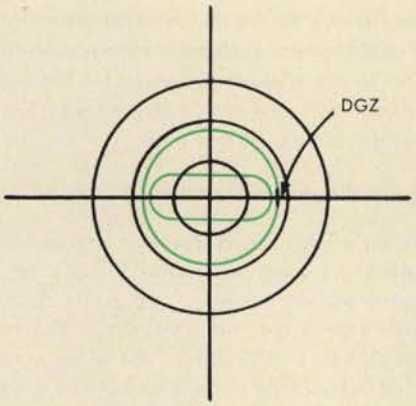
1. Effects radii are expressed as curves which vary with a height burst scale. They are conveniently located on facing pages using a series of indices.
2. The Height of Burst Selector is placed on a quarter page with a selector on either side of the page. This quarter page is mounted between the pages which express the effects radii.
3. The Horizontal Error Indicator can be located in any convenient spot. Usually it is most conveniently located in close proximity to the Height of Burst Selector and can therefore be placed on the same quarter page with that device.



No. 23



No. 24



Target Analysis with Q–STAR

Although there must be a certain amount of flexibility in any analysis system, Q–STAR presents here a step by step procedure for target analysis. The reader should realize that the steps used by Q–STAR may be varied in scope and content, order of accomplishment, and the like, but they represent the minimum factors that must be taken into account when analyzing any target.

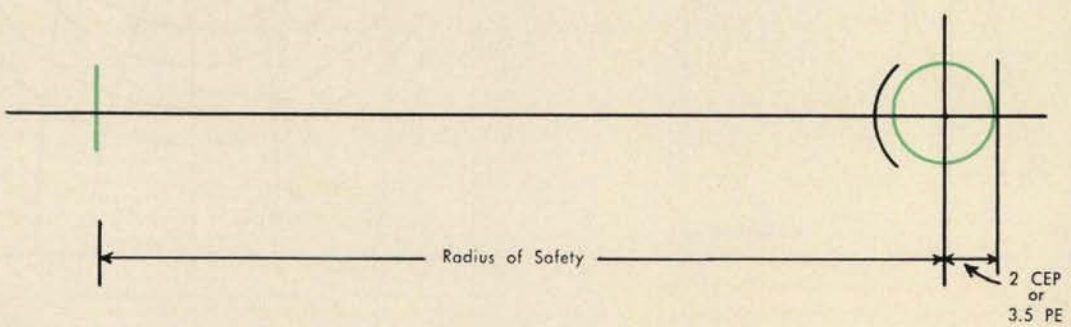
Step 1: On the circular scale portion of the acetate reader draw the 2 CEP or 3.5 PE horizontal dispersion patterns for all delivery systems under consideration using the Horizontal Error Indicator.

Step 2: Eliminate weapons that are unsafe for friendly troops, either because the safety radius associated with the weapon is too great, or the weapon at maximum delivery error places effects on our own troops. On the acetate reader (again on the circular scale) mark the distance from a tentatively selected Desired Ground Zero (DGZ) to the nearest friendly troops. Now eliminate unsafe weapons by applying the circular scale just marked to the safety indices for the available weapons, which we described in our discussion of the effects radii. Now instead of placing the index of the circular scale on the casualty index to measure the radius of safety for friendly troops, offset the circular scale to the maximum error indicated for each delivery system. Let us for example assume a negligible risk to our own troops who are warned and exposed, in other words they have been warned of the impending attack but have not had time to dig foxholes. The picture we described would then look like the chart above.

We offset the circular scale index by 2 CEP or 3.5 PE to take into account the fact that the weapon may fall in error from the Desired Ground Zero (DGZ) in the direction of friendly troops by that distance for the required assurance. We have actually expressed graphically what is commonly called a *Minimum Safe Distance*. The Minimum Safe Distance is defined as the radius of safety plus 2 CEP or 3.5 PE in horizontal error. This tabulation gives us the radius of hazard to friendly troops and offsets the weapon by sufficient horizontal errors to insure that the round will not fall in error so far that friendly troops will be exposed. The radius of safety and the error values can be read from tables and added. Q–STAR solves the problem graphically with the same elements as shown below.

Step 3: If troop safety is no problem (for deep targets) Step 2 can be eliminated. Now on the acetate reader draw on the circular scale a circle which covers the target to the extent required by the commander's guidance. One-third to one-half coverage (representing one-third to one-half damage or casualties) should be sufficient to render a troop unit non-effective under most circumstances. From the weapons available, select by graphical comparison with the effects radii a weapon yield that satisfies the damage or casualty requirements.

Step 4: Using the Height of Burst Selector and the effects radii select a height of burst and delivery means



No. 25

which will produce maximum effect at delivery range as was done in our previous illustration.

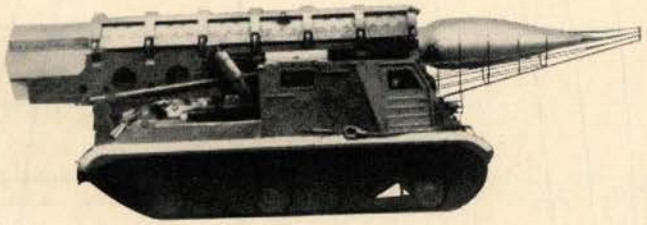
Thus we have selected:

1. A yield and associated weapon and delivery means using the effects radii and the Height of Burst Selector. We are furthermore 98% sure that the weapon will detonate at a burst height which will give us at least effects we have represented.

2. A delivery means for the weapon which gives us a 98% assurance that the weapon will detonate in the correct height of burst range, and a 94% assurance that the weapon will cover the target to the required degree.

3. A weapon that is 99% safe for friendly troops, in a linear disposition.

Isolated target elements or small groups of targets are easily treated by Q–STAR. Suppose we are attacking a guided missile launcher.



In this case we select a weapon such that the damage radius for the target element being attacked is equal to or greater than 4 CEP or 7 PE in horizontal error. This means then, that if the weapon falls off the target in delivery error by as much as 2 CEP or 3.5 PE, we still have the target element within the radius of almost certain damage. For a lesser assurance of damage values smaller than 4 CEP and 7 PE could be selected for a required damage radius.

For more than one target we proceed as follows: (Assuming now 2 launchers)

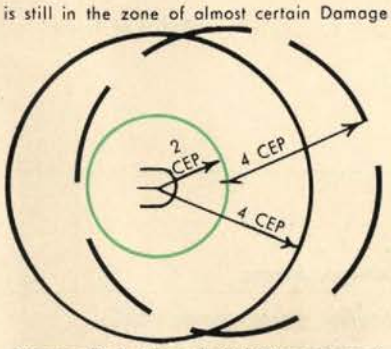
Step 1: Measure the distance between the launchers.

Step 2: Equate this distance to 2 CEP or 3.5 PE. For more than two such targets merely take the largest distance between any two target elements and equate it to 2 CEP or 3.5 PE.

Step 3: Double the distance obtained in step 2 (now we have 4 CEP or 7 PE) and select a weapon yield with at least that radius of effect for the target element in question, and a delivery means at least as accurate as the CEP or PE requirements indicate.

Step 4: Select the correct height of burst and delivery means as before, check troop safety and other limiting requirements that may have been placed on the weapons employment.

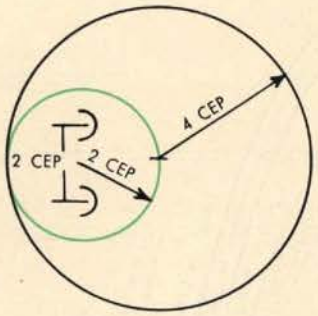
If Weapon Falls 2 CEP or 3.5 PE in error the Target is still in the zone of almost certain Damage



Damage Radius for selected Weapon equal to 4 CEP or 7 PE for very high assurance

No. 26

This procedure gives us a high assurance that the weapon will damage the target, for if the weapon varies in error from the Desired Ground Zero (DGZ) by as much as 2 CEP or 3.5 PE both targets will still be within the zone of almost certain damage.



Now if the weapon falls 2 CEP or 3.5 PE away from the center of the target, the launchers are both within the zone of almost certain damage.

No. 27

So Q–STAR can analyze not only large area type targets but individual target elements or groups of target elements as well.

What does the Q–STAR analysis give us?

1. A weapon yield that will burst within a height of burst range that is fallout safe and which produces at least the selected radius of effects 91%-98% of the time.

2. A realistic description of horizontal delivery errors.

3. A weapon whose effects will adequately cover the target at least 94% of the time.

4. A weapon so employed that we have a 99% assurance that friendly troops will not be exposed.

This is indeed a qualitative analysis. Yet it can be accomplished with:

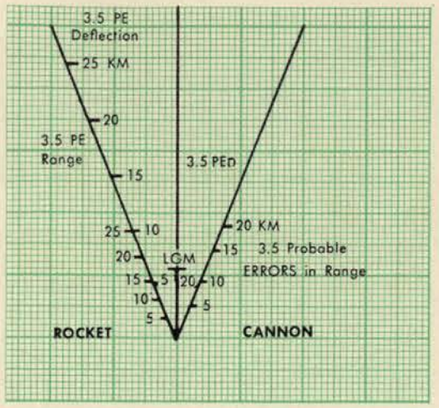
1. A set of simple Q—STAR charts (one per available weapon yield).

2. An acetate reader which combines a probability indicator for height of burst with a circular scale.

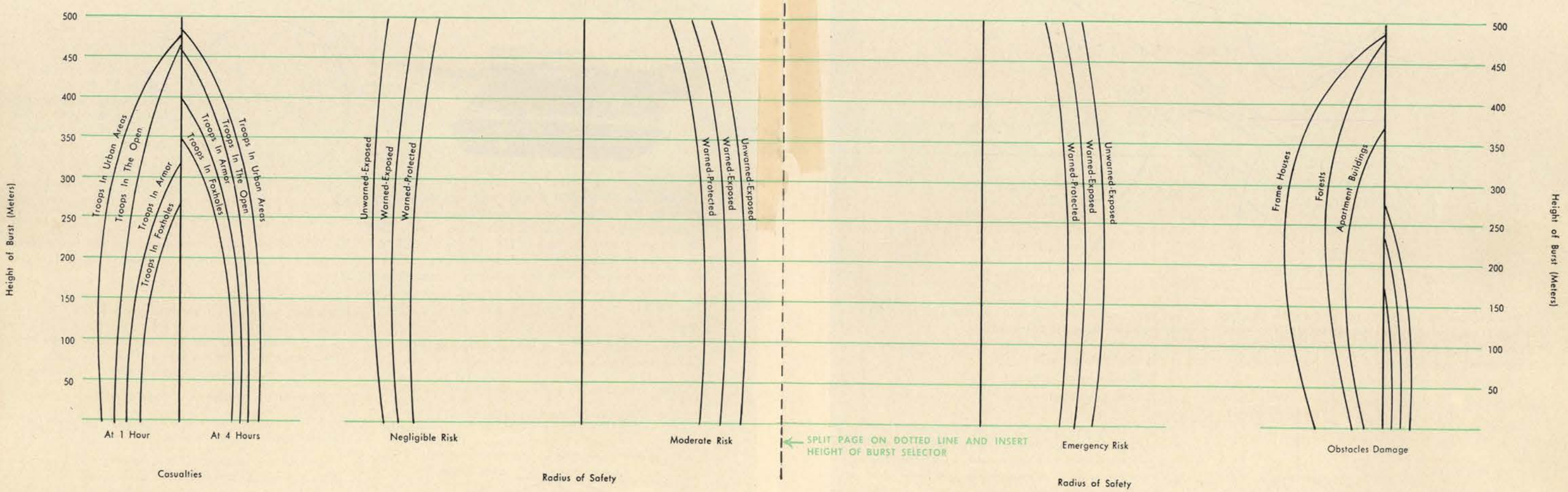
3. A grease pencil.

4. *No mathematical calculations.*

5. An absolute *minimum* of time.



2 KT YIELD WEAPON



AVAILABLE DELIVERY SYSTEMS

		Delivery Errors			
		Horizontal			Vertical
Delivery Means	Range	Range (PE_R)	Deflection (PE_D)	CEP	Burst Height
Medium range cannon (MRC)	10 km	Range/200	Range/500		Range/200
Long range cannon (LRC)	20 km	Range/200	Range/500		Range/200
Small free rocket (SFR)	25 km	Range/250	Range/100		Range/250
Light guided missile (LGM)	50 km			100m	10m

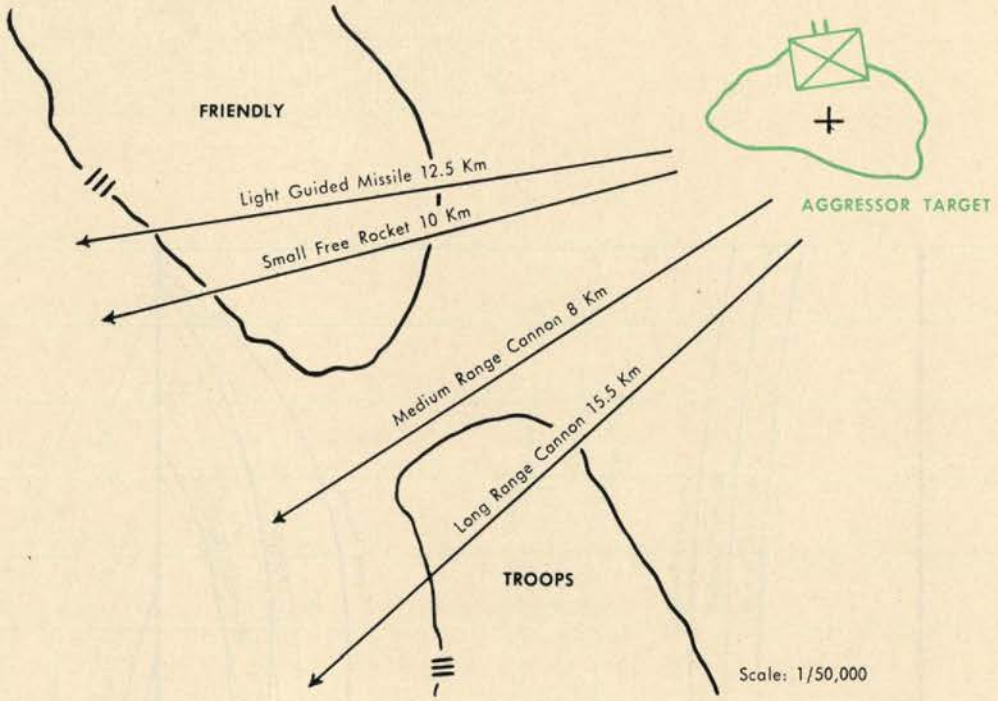
Guidance for solution of the problem on the preceding two pages is as follows:

1. One-third to one-half casualties to troops in foxholes within one hour.

2. No fallout contamination.

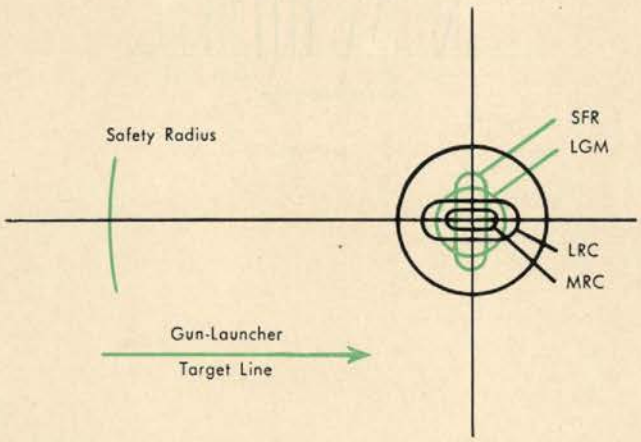
3. No more than a negligible risk to friendly troops who are warned but have not had time to dig foxholes (warned-exposed). Graphically this is shown on No. 28.

merely mark on the acetate reader the radius of safety for negligible risk to troops that are exposed and warned. This distance has been indicated on the illustration above. Examination of each delivery system in turn then eliminates the long range cannon as unsafe. Here we use the technique described previously, graphically visualizing the effects of maximum error in the direction of the friendly troops. The elongated range dispersion pattern of the long range cannon throws the radius of safety



No. 28

Step 1: Draw the dispersion patterns for the delivery systems in question on the acetate reader. Using the Horizontal Error Indicator as described previously we develop a picture that looks like this:



No. 29

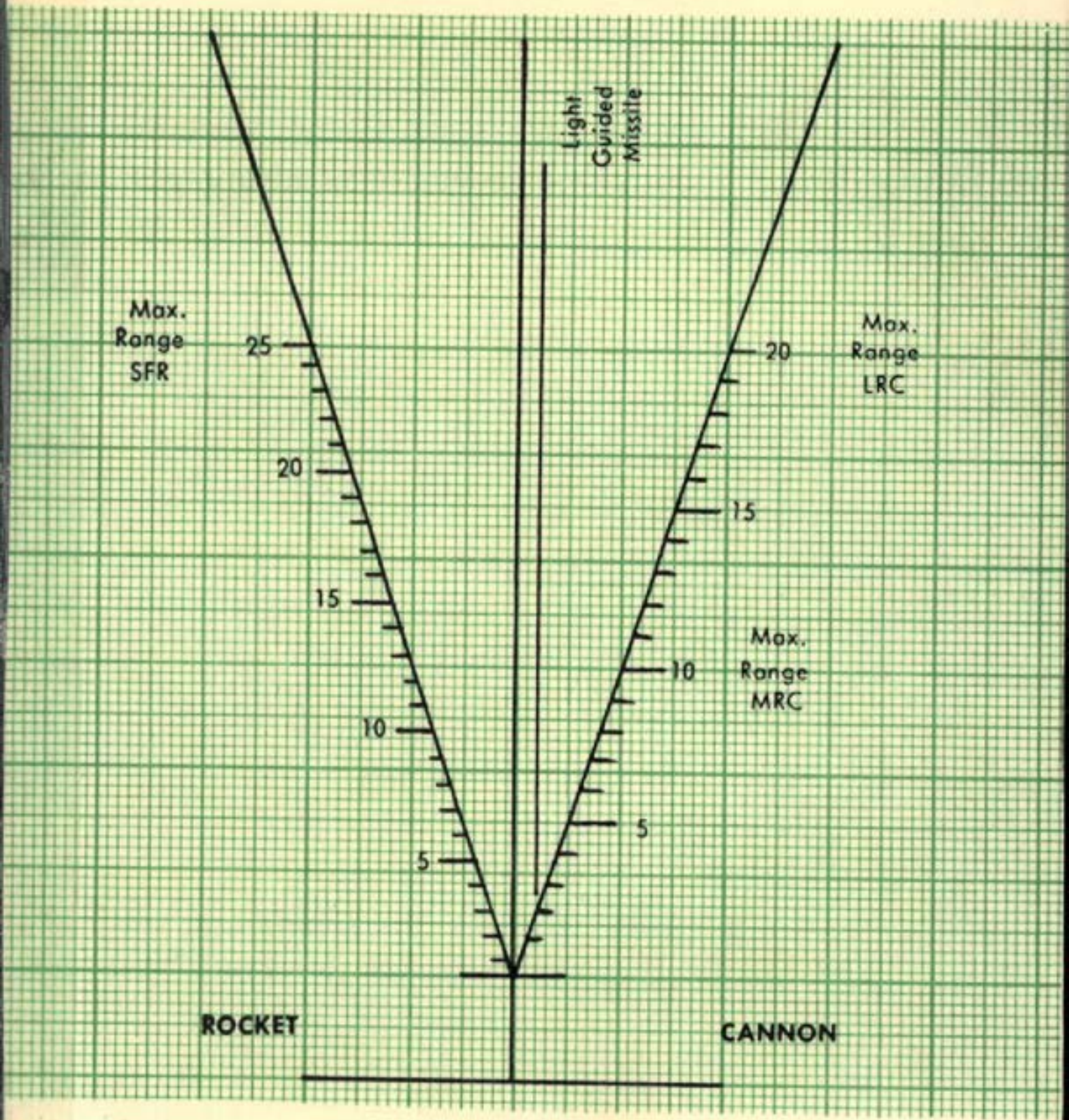
Step 2: Eliminate weapons that are not troop safe. Since we are considering a single yield weapon, we into the friendly troop disposition at maximum error. So we are now reduced to considering:

1. Light guided missile
2. Medium range cannon
3. Small free rocket

Step 3: Scribe with grease pencil on the acetate reader a circle that covers one-third to one-half of the target. Since we are limited to a single yield in this illustration a simpler procedure is to combine this step with:

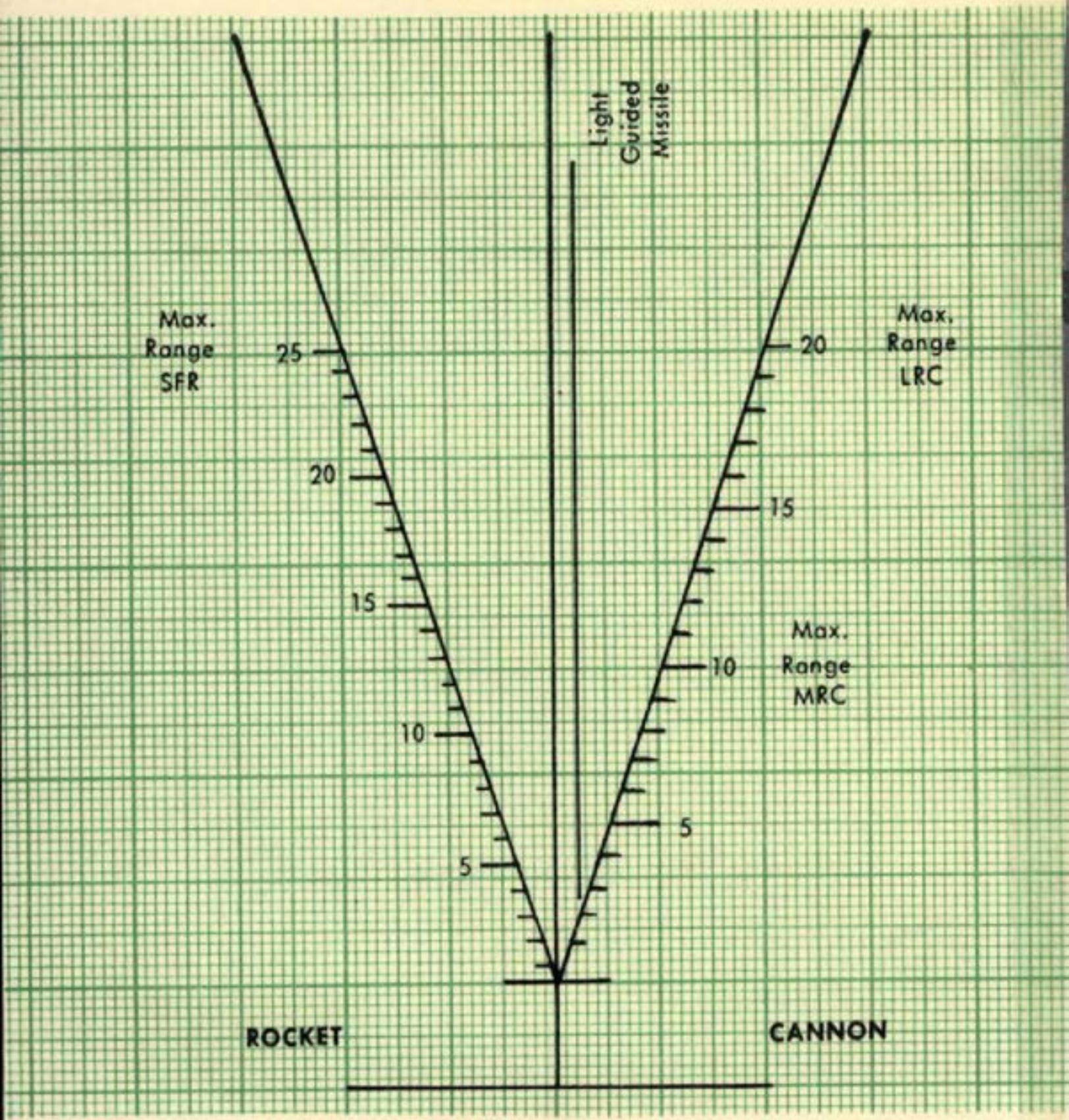
Step 4: Using the Height of Burst Selector and the effects radii for the 2-KT weapon select the delivery means that gives the maximum effects. Now as we described before, place the acetate reader on the Height of Burst Selector at a point where the very high assurance line on the probability indicator rests on the proper distance scale for the cannon and the rocket, or on the intersection of the vertical index for the light guided missile with the outward sloping line which represents a very high assurance. Note that for the rocket and cannon a burst height high enough to be fallout safe at the employment ranges will not provide the desired assurance of limiting the upper extremities of the height of burst. Marking the casualty radii as described in the text we read

HEIGHT OF BURST SELECTOR



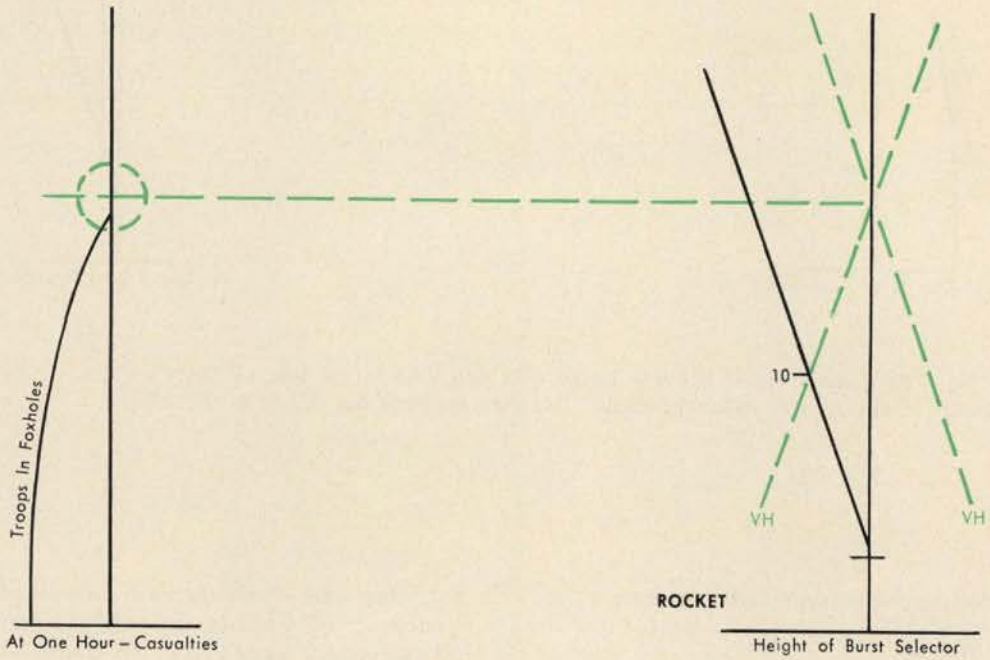
SEE PAGES 32-33

HEIGHT OF BURST SELECTOR



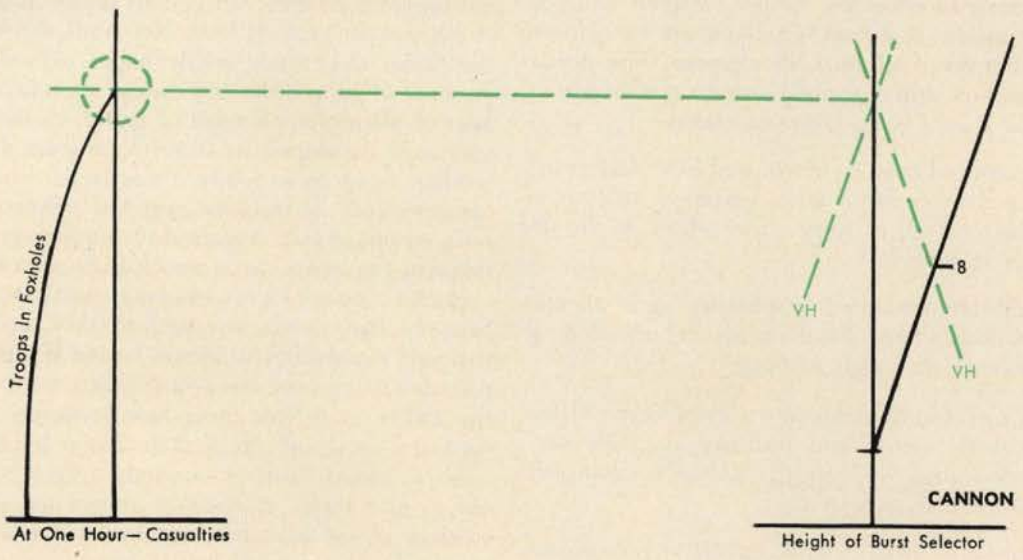
SEE PAGES 32-33

a radius of damage for the light guided missile delivered weapon only. The cannon and rocket delivered weapons at 3 probable errors above the fallout safe burst height may burst at a height at which there is little or no effect on the target. Applying the indicated casualty radius to the target we find that at maximum error the weapon effects cover about one-third to one-half of the target. Graphically:



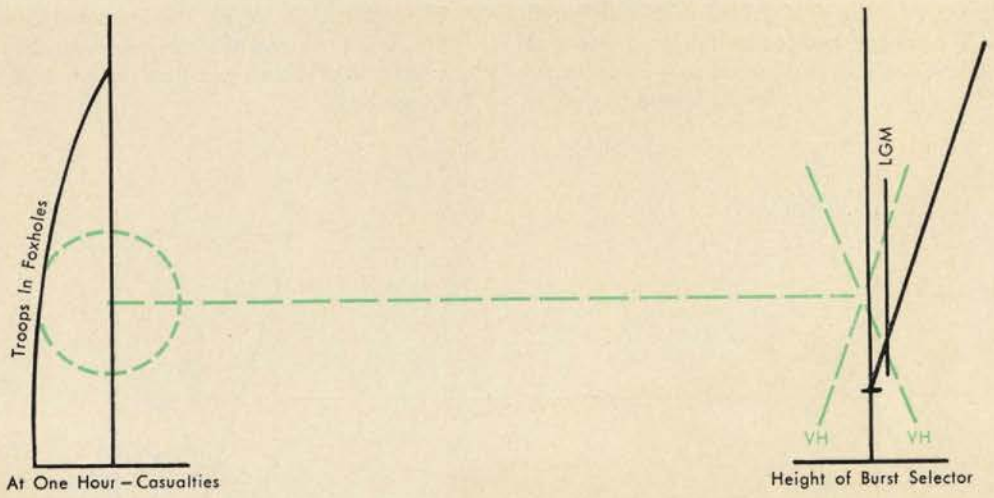
No. 30

Examination of the Rocket delivered weapon—At 10 kilometers range the fallout safe burst height will of course produce casualties, but note that at 3 probable errors above the fallout safe burst height we anticipate no damage. Since this is all we can depend on with the required degree of assurance, we must eliminate this delivery capability.



No. 31

Examination of the cannon delivered weapon—At 8 kilometers range the fallout safe burst height will definitely produce casualties, however as before a burst 3 probable errors above this height will leave us with little or no damage within the required assurance limits. Cannon delivery must likewise be rejected.



No. 32

Examination of the light guided missile delivery system—As described in the text we find that for a very high assurance the maximum radius of effects is as indicated above. This then becomes our radius of casualties.

Recommendations to the commander then are:

2-KT Yield Weapon
Light guided missile delivered
Desired Ground Zero at Target Center (use map coordinates)
Height of Burst 80 meters (read directly from Height of Burst Selector)

Summary

A Summing Up for Q–STAR then reveals that:

• We have a graphical device (Height of Burst Selector) which permits us to select the proper weapons and correct delivery means based on simultaneous comparison of the vertical errors of all available weapons. This device further provides us with a positive assurance in height of burst and of at least a given radius of effects.

• A second graphical device (Horizontal Error Indicator) furnishes immediate, simultaneous, graphical analysis of the exact patterns of all delivery errors related to the desired assurance in probability.

• Effects radii are presented graphically in a manner which allows immediate, simultaneous visualization of their variation with the height of burst.

• By combining these elements into a set of simple charts (one per available yield) and utilizing an easily constructed acetate reader, we have the tools for a complete qualitative target analysis system.

• Target analysis with Q–STAR results in a complete, rapid, high quality solution to the many complex problems involved in the selection of yield, weapon, delivery means, height of burst and estimation of damage for nuclear weapons employment.

• We have a complete target analysis requiring no more than a few minutes for the most difficult problems normally encountered. Further, the only equipment required for full analysis is a set of Q–STAR charts, an acetate reader, a grease pencil.

• The target analysis can be accomplished in a foxhole, personnel carrier, tank, reconnaissance vehicle, aircraft, in short anywhere on the battlefield that a man can go. Analysis can further be completed in a minimum of time, with a minimum of equipment, with a maximum assurance of selecting the proper weapon, correct delivery means and exact burst height.

On fields which have stood witness to his wars, man has fought a timeless struggle to bring his tactics abreast of his weapons capabilities. Not until the War Between the States did tactics finally begin to acclimate to the presence of gunpowder and combat cannon and rifles with lines of skirmishers instead of grand squares. Yet at that very time developments were in progress which were to produce weapons to render those tactics obsolete. For by century's end the machine gun was prepared to strip the mobility out of war. A tactical revolution—yet on its heels, following so swiftly as to astound the most flexible mind, appeared the tank—a machine to restore mobility to battle. Scarcely had tactics adjusted to this revolution when weapons capabilities suddenly bounded ahead in unsurpassed measure once more—man fractured the atom. Then the ability to deliver these new fearsome weapons suddenly rocketed and missiled to almost limitless horizons.

So we stand forth in our time against a challenge as old as war itself, as thought provoking, as difficult of solution as any man has ever faced. For if these instruments of violence are to be responsive tools which we can command to their tasks we must be their masters—not their slaves. To master them we must equip ourselves with simple, efficient, accurate, rapid tools of application.

Such are the tools of Q–STAR—a qualitative system of target analysis.

(U. S. Army)

Machine Gun Training: A Neglected Subject

By FIRST LIEUTENANT RICHARD M. MEYER

WE have many persons firing machine guns that do not know proper disassembly, assembly and headspace adjustment. Many armor crewmen have fired cupola mounted machine guns but they are incapable of checking the timing, mounting the gun in the cupola and delivering accurate fire.

The majority of tank crews that fail to attain a high score on a tank crew proficiency course will readily admit that it was because their machine guns failed to fire satisfactorily.

The basic trouble is not the equipment. The M37 caliber .30 machine gun, the caliber .50 HB M2 machine gun or machine guns mounted in either the M1 or M3 cupolas *will work*. VIPs continually watch demonstrations where they see coaxial and cupola mounted machine guns firing perfectly. The reason that these weapons fire correctly for a demonstration is because one or two machine gun specialists set up each gun individually to fire correctly. The weapons for demonstrations are then fired by the best qualified personnel available.

When a newly inducted soldier has completed his 16th week of military training, he has received a total of only eight hours of machine gun instruction as compared to 96 hours with the M1 rifle. To be proficient with either the caliber .30 or caliber .50 machine guns, the related field manuals state that a minimum of 20 hours is necessary for familiarization training and approximately 175 hours of instruction are necessary prior to the small unit phase of training for each weapon.

It is apparent that a revitalized machine gun training program must be instituted that will produce a tank crew wherein all crew members are thoroughly trained in the use of the tank's machine guns. Training time must be made available to permit mortar crewmen to thoroughly learn the caliber .50 machine gun and the operation of the M13 cupola that is mounted on the M84 mortar carrier.

FIRST LIEUTENANT RICHARD M. MEYER, Armor, was an enlisted man in the Navy prior to attending College. A 1953 graduate from Michigan State, he was commissioned and attended the Basic Course at Knox. He was assigned to Germany where he spent several years with the Seventh U. S. Army Tank Training Center and was closely associated with many of the problems discussed in this article. He is attending the Advance Class at the U. S. Army Armor School.

Caliber .30 Machine Gun Training

Since the average tank crew will fire its machine guns more than a rifle or a pistol, it is apparent that machine gun training should begin as early as possible during the basic or advanced individual training phases. The mastering of the caliber .30 machine gun during basic training would permit an easier transition to the caliber .50 machine gun during the advanced individual training phase. At present sufficient time is not available during basic training to include machine gun subjects; however it should be the first subject that is added when "M-Day" training periods are lengthened or if any present subject matter can be shortened.

In addition to a sound basic training program for caliber .30 machine guns, the following yearly familiarization program is recommended for all armor crewmen:

8 hours—disassembly, assembly, headspace adjustment.

4 hours—mounting, bore sighting, solenoid adjustment.

4 hours—care and maintenance.

4 hours—firing (preferably from ground mount).

4 hours—turret firing to include proper method of fire.

During all phases of training, nomenclature and functioning should be mentioned but not as something requiring rote memory. Once an individual can successfully and consistently fire a gun he will have developed enough pride in it to learn all he can about his weapon.

Caliber .50 Machine Gun Training

Due to the number of caliber .50 machine guns in an armor unit, the limited space available in a cupola and added safety considerations, it is imperative that all armor personnel be required to fire the ground mounted caliber .50 machine gun. Further, if an individual does not know the basic ground mounted weapon, he should not be permitted to fire a cupola mounted gun that requires additional skills. The yearly .50 caliber familiarization program would therefore only deviate slightly from the caliber .30 program with the additional requirement for timing adjustment instruction.

LIST OF COMMON MACHINE GUN DEFICIENCIES

CALIBER .30 COAXIAL MACHINE GUN

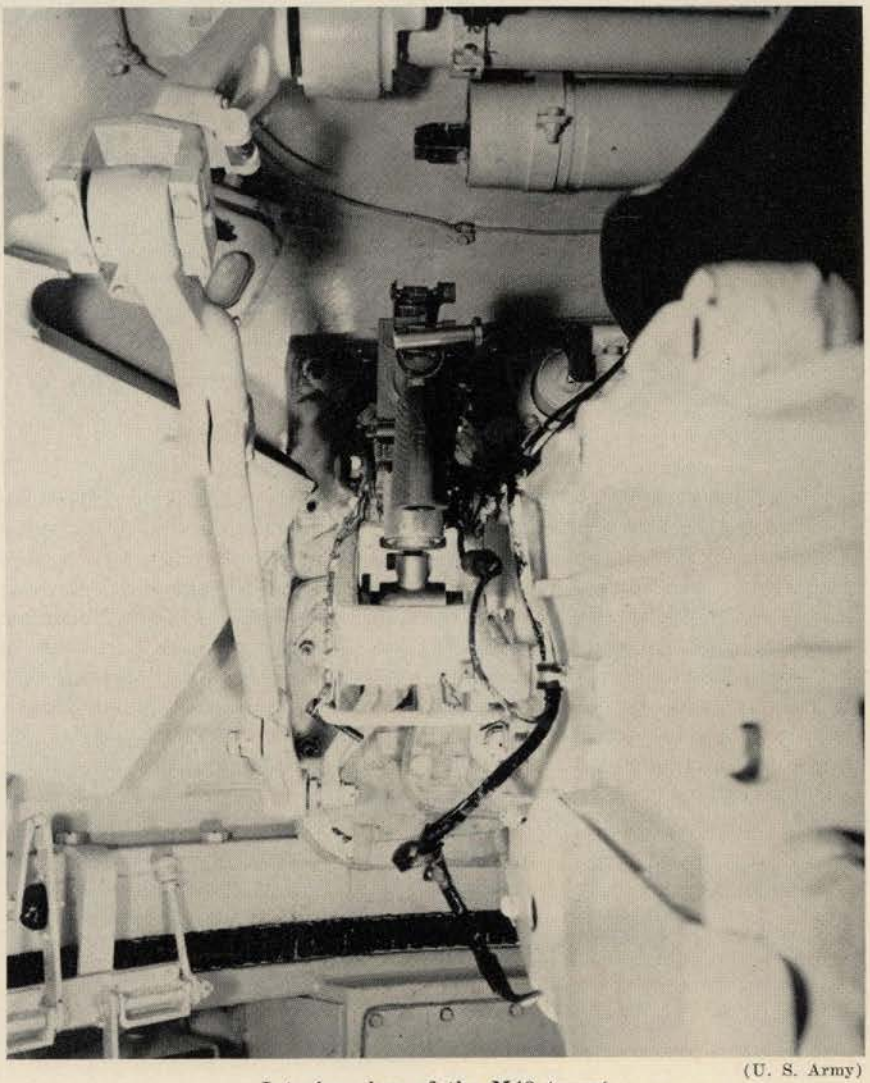
- Improper headspace
- Loose bolts on gun mount
- Loose barrel bearing
- Improper solenoid adjustment
- Jam nuts not tightened on elevating and traversing bracket

CALIBER .50 M2 HB MACHINE GUN

- Bolt switch improperly mounted
- Timing
- Headspace
- Inability to clear weapon
- Bolt latch release lock not engaged

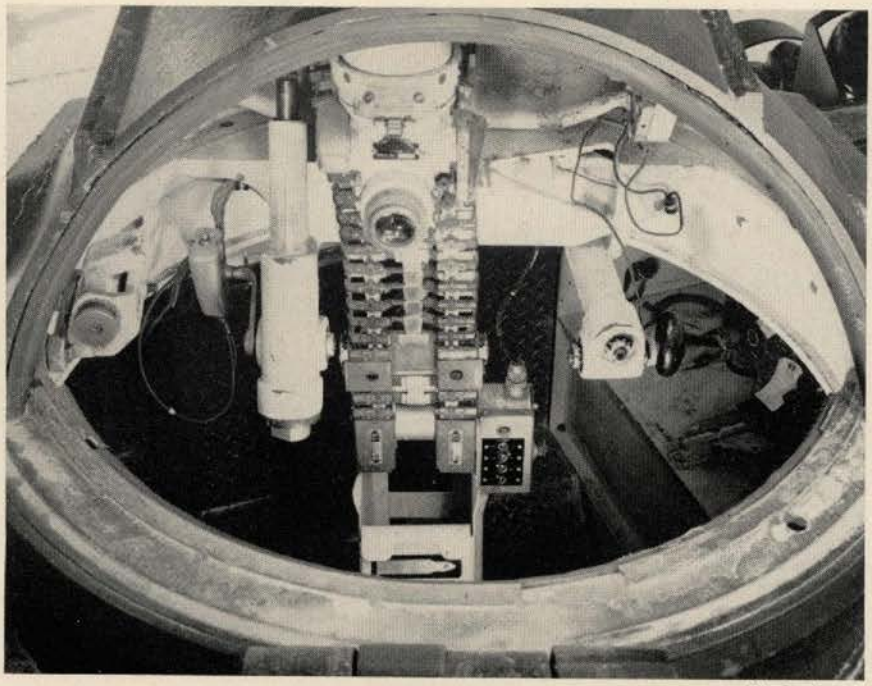
CUPOLA MOUNTED MACHINE GUNS

- Gun adapter improperly aligned in M13 Cupola
- Solenoids not properly adjusted in M1 and M13 cupolas
- Incorrect setting of booster pressure in M13 cupolas
- Machine gun not boresighted in M1 and M13 cupolas



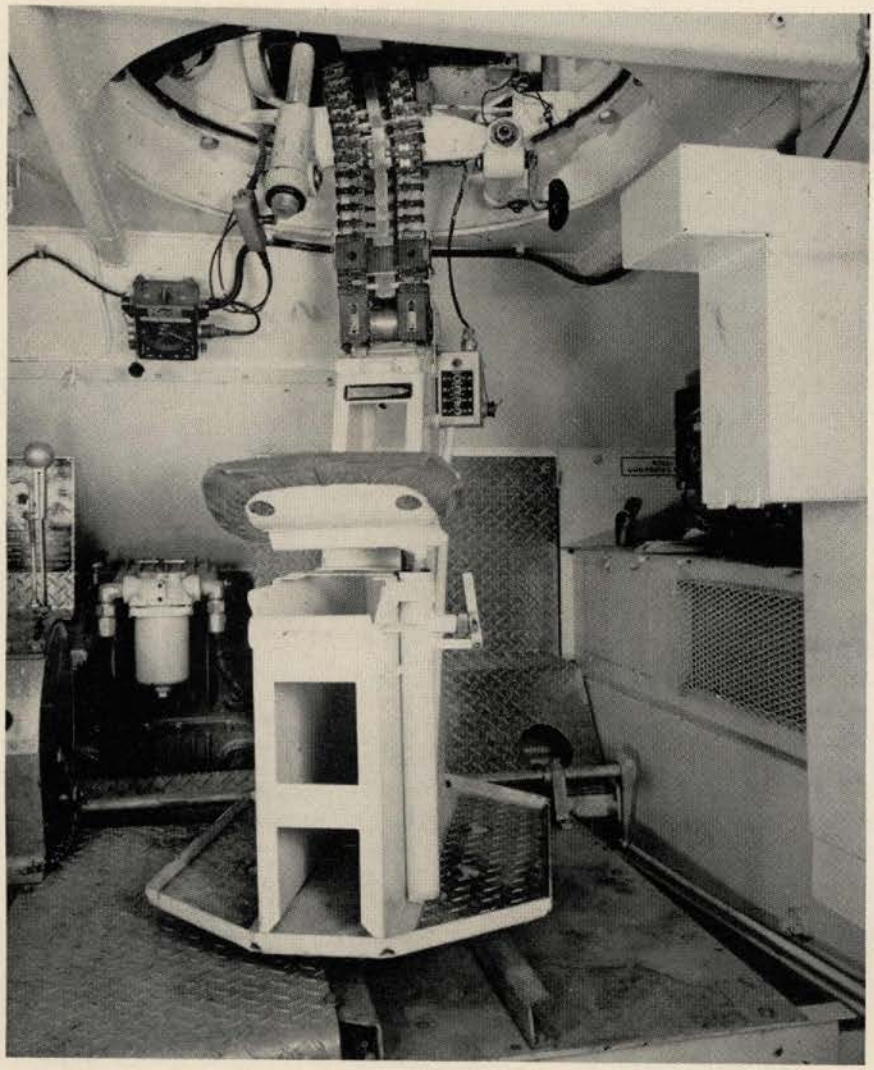
(U. S. Army)

Interior view of the M48 turret.



(U. S. Army)

Interior view of the M13 cupola.



(U. S. Army)

Interior view of commander's cupola on the M13.

Preliminary Gunner's Test

Before a tank crewman engages in the tank gunnery qualification program, he should be required to complete satisfactory preliminary gunner's tests on both tank machine guns. With the addition of this requirement, the actual sub-caliber and service firing will proceed more successfully. The caliber .30 gunner's test is set forth on page 419 in FM 23-55 and the caliber .50 gunner's test is set forth on page 200 in FM 23-65. All tank crewmen should be required to attain a score of 80 or higher on both these tests before they are permitted to fire the sub-caliber tables.

Caliber .50 Firing Table

Table XVII as prescribed in FM 17-12 for caliber .50 machine gun firing should be fired yearly and be expanded to require mounting, solenoid adjustment and removal of the gun from the cupola.

Summary

It is realized that much of the difficulty in firing the cupola mounted machine guns was due to the lack of publications being delivered with the weapons. This situation is now being corrected with the publication of pertinent FMs and TMs. However, even if these publications had been available, there has not been sufficient training time allocated to adequately train a soldier in firing the machine guns.

Squad leaders and vehicle commanders must closely supervise all work with the machine guns until all crewmen are capable of disassembly, assembly, setting correct headspace, timing, solenoid adjustment and correcting malfunctions.

> Training of armor individuals, units, and combined-arms formations must be oriented toward developing, to the maximum, the characteristics of mobility, firepower and shock action.

This extract of armor training objectives from FM 17-1 specifically states that we must reorient the machine gun training program if we are to attain maximum firepower from vehicular mounted machine guns.

Is The Sea Mistress Feasible?

By MAJOR JOHN C. BURNEY, JR.

YOU the taxpayer must pay *millions of dollars* for each airfield constructed by the United States in such overseas areas as Spain and Saudi Arabia. However, at no cost whatsoever nature has furnished us with thousands of runways spread throughout all parts of the world. Furthermore, nature's runways cannot be destroyed by atomic bombs.

The construction of mammoth water-based transport aircraft capable of operating from coastal areas, rivers and lakes is currently under consideration. But are such aircraft feasible considering only geographical factors? Are there sufficient landing areas to support the water-based transport concept? To answer these questions, let us examine the potential landing areas and their locations in relation to possible military targets.

Any such survey of potential landing areas must be made with a full realization of the military potential of water-based transports. The principal advocate of such aircraft, The Martin Company, has proposed a huge seaplane called the Sea Mistress. This airplane would have a gross weight of 200 to 300 tons and would be powered by eight or ten jet engines.[1] It would be designed to carry 400 soldiers for 3,500 miles. Its maximum payload would be approximately 130 tons.[2] With this enormous capacity, the Sea Mistress could carry our heaviest combat vehicles and could be used effectively for both the movement and resupply of combat units.

Before we select landing sites for the Sea Mistress, we must first establish criteria based on the landing area requirements of the Sea Mistress. The static draft of a fully loaded Sea Mistress would be only eight and one-half feet.[3] Therefore, the minimum depth required for landing areas would be about ten feet.[4] As for the length of landing sites, only one mile is needed.[5] However, many lakes of this size would require advance preparation. To avoid all questionable sites, a conservative runway length of three miles will be used as a criterion. The width required for landing the Sea Mistress is approximately 500 feet. These meager landing area requirements make the Sea Mistress concept especially appealing.

The landing area criteria can be applied to potential sites without considering obstacles or enemy countermeasures. Bombs cannot destroy self-sealing water runways, and it would be impracticable to mine many water landing areas. To mine the lakes of Poland alone would require the entire estimated Soviet stockpile of mines.[6] Floating debris would probably not be dangerous. A test pilot of a Martin P6M seaplane stated he believes that he has struck floating objects as large as telephone poles without damaging his aircraft.[7] Rough water would not be a serious problem, for the Sea Mistress could be designed to land and take off in ten-foot waves.[8] However, for this survey the only coastal landing sites that will be considered will be protected bays, gulfs and inlets with beaches suitable for amphibious operations. Ice-covered landing sites would normally require advance preparation. The ice must either be broken up or it must be thickened. Approximately 40 inches of ice will support Sea Mistress landings.[9] Because neither nature nor man can deny most water runways, these runways would be ideal for military operations in any season of the year.

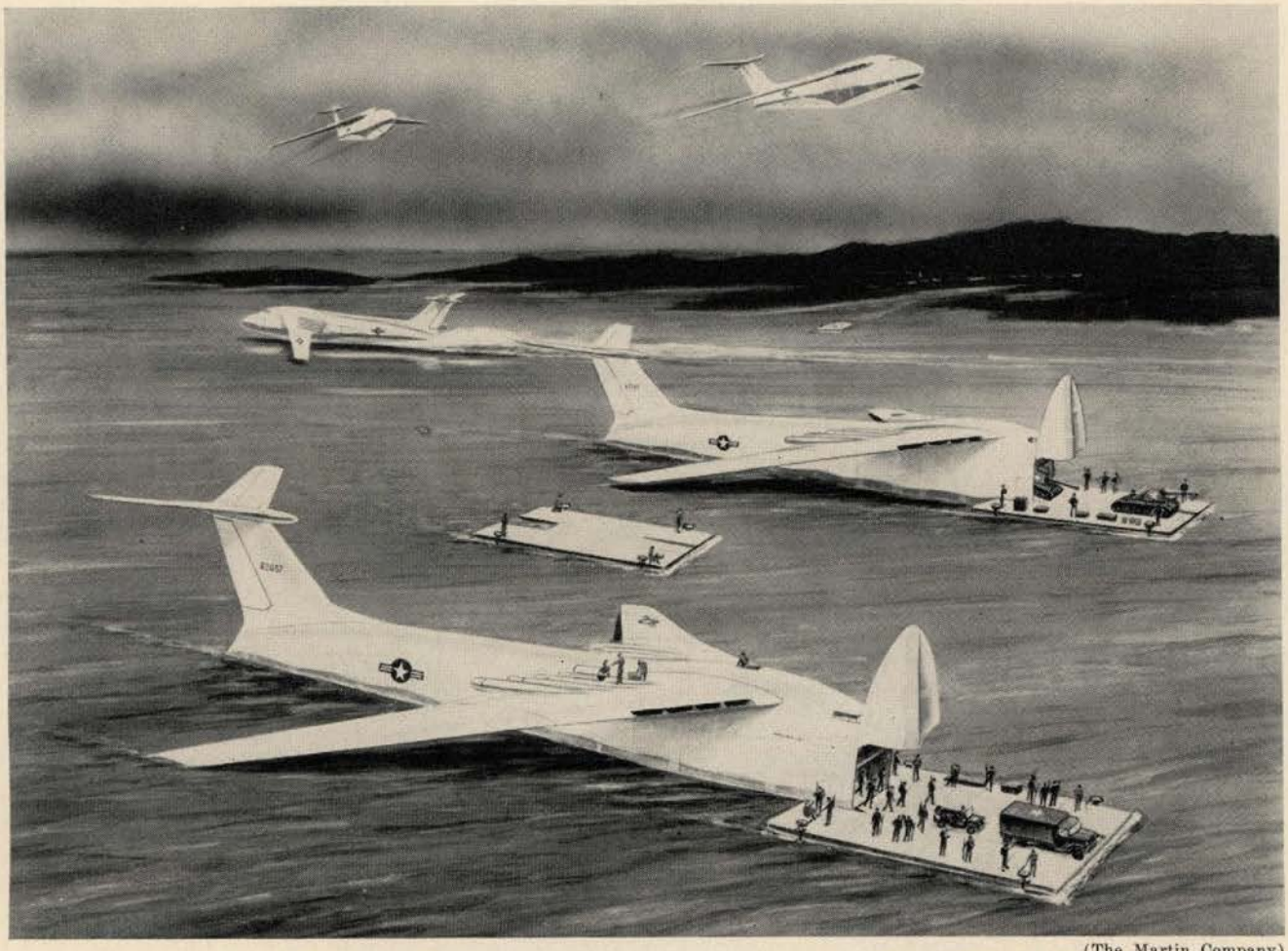
A survey of potential landing sites need not include consideration of the availability of ramps, docks or unloading facilities. The Sea Mistress concept includes the use of self-propelled rafts, which would be carried by the aircraft. These rafts are pictured unloading Sea Mistresses in the photograph shown on the next page. As for maintenance, the Sea Mistress would be serviced on the water; and ramps would be needed only for major repairs in rear areas.[10] The only requirement in the objective area is for the water runways themselves.

With the simple landing area needs of the Sea Mistress in mind, let us now examine the earth's hydrosphere —its mantle of water. Water covers 72 percent of the earth's surface.[11] The number and complexity of the oceans, seas, river systems and lakes that cover the globe prevent a survey of the entire world in this short study. Therefore, only two vital areas will be examined—Europe and Southeast Asia.

Europe has been recognized for centuries as a dominant area. With a population of 400 million, Europe is the world's most densely settled region.[12] Because of its heavy concentration of industry and its important deposits of iron, coal, bauxite and manganese, Europe provides an economic balance of power between the East and the West. Surely Europe warrants first consideration in determining the geographic validity of the Sea Mistress concept.

For the purposes of this study, only the key mainland region will be considered. This 1,250,000 square mile area includes France, Germany, Belgium, Netherlands, Portugal, Spain, Switzerland, Denmark, Austria, Italy, Yugoslavia, Albania, Greece, Bulgaria, Rumania, Hungary, Czechoslovakia and Poland.

MAJOR JOHN C. BURNEY, JR., Armor, graduated from USMA in 1946. He served in USCONARC Board #1 at Fort Bragg where he devoted considerable time and effort to airlift problems. He next was assigned to the G3 Section, Fifth Air Force, FECOM. Returning Stateside he was an instructor at the U. S. Army Armor School. Following attendance at C&GSC he is presently an instructor at USAAMS, Fort Sill, Oklahoma.



(The Martin Company)

An artist's concept of the Martin Sea Mistress unloading tanks and troops on self-propelled rafts carried by the plane.

Potential landing sites for the Sea Mistress, selected on the basis of the conservative criteria, abound throughout Europe.[13] The long, irregular European coastline, with its numerous gulfs and deep bays, is ideally suited for seaplane operations. The only coastal area lacking adequate landing sites is the eastern shore of the Adriatic Sea. Europe also boasts many wide, deep rivers, which stretch far into the mainland. The Rhine, the most important river in Europe, provides landing areas throughout almost its entire length. Other important rivers usable by the Sea Mistress include the Danube, Rhone, Seine, Loire, Garonne, Oder, Po, Elbe and Vistula. In this section of Europe there are 3,100 miles of rivers suitable for landing large seaplanes. There are 362 usable lakes, distributed as shown in the chart, which complete this vast complex of landing sites.[14]

Nearly all of Europe is vulnerable to attack by forces landed by water-based transports. Almost 95 percent of Europe's land area is within 100 miles of seaplane landing sites. Thus, 95 percent of Europe is within striking range of combat forces landed by the Sea Mistress (based on the ranges of modern tanks and armored personnel carriers). This accessible region includes every national capital of Europe, every large communication center, and every major seaport. As for critical terrain features, *every* vital locality—Gibraltar, the Belfort Gap, the Lorraine Gap, the Rhone Corridor, the Toulouse Gap, the Rhine Graben, the Linz Corridor, Peartree Pass, the English Channel, the Belgian corridor, the Hessian corridor, the Kattegat, the Vienna gate, the Moravian gateway, the Sofia corridor, the Dardanelles, the Sicilian Straits and others—is within 100 miles of potential Sea Mistress landing sites.

European Lakes
Three Miles or More in Length

Czechoslovakia	2
Denmark	11
France	12
Germany	92
Greece	22
Hungary, Yugoslavia and Albania	13
Italy	23
Netherlands, Belgium and Luxembourg	6
Poland	105
Rumania and Bulgaria	28
Spain and Portugal	13
Switzerland and Austria	35
Total	362

But what of Europe's natural resources? Because of the limited scope of this study, only selected resources of strategic value will be considered—chromite, manganese, tungsten and petroleum. The United States must import 98.4 percent of its chromite, 97.0 percent of its manganese, and 72.5 percent of its tungsten.[15] Major deposits of chromite exist in Greece and Yugoslavia; manganese in Italy, Hungary and Rumania; tungsten in

Spain and Portugal; and petroleum in Rumania and Austria.[16] Of these, the only deposits outside the striking range of forces that could be delivered by the Sea Mistress are one source of tungsten (in Spain) and one source of manganese (in Rumania). Certainly Europe is ideally suited for the employment of water-based transports!

But what of larger, less developed regions? The mainland of Southeast Asia covers 3,750,000 square miles. This area, which includes Pakistan, India, Burma, Thailand, Malaya, Cambodia, Laos, Vietnam and the majority of China, is three times as large as the European area considered.

Like Europe, Southeast Asia contains a large percentage of the earth's population. One-fifth of all of the people in the world are Chinese and another fifth are Indian.[17] While Southeast Asia is not a major industrial area, it is rich in raw materials. Approximately 90 percent of the world's rubber is produced in Southeast Asia. Also, there are large deposits of tin, tungsten, manganese and chromite, all of which must be imported in great quantities by the United States. Largely because of these vital resources, Southeast Asia has become a major battleground in the cold war between the East and the West. This cold war could flare into a local war at any time because of Asia's large, restive population. Therefore, a survey of potential landing areas in Southeast Asia is especially appropriate.

A study of Southeast Asia's water systems shows that potential landing areas for the Sea Mistress are generally plentiful along the coasts.[18] The only coastal sections lacking good sites are the northeastern shore of China along the Yellow Sea and the shore of Northeastern India and East Pakistan in the Bay of Bengal. There are many long rivers throughout this area that meet the landing area criteria. Especially promising are the Yellow, Hsi Chiang and Yangtze Rivers in China; the Mekong River in Laos and Cambodia; the Irrawaddy and Salween Rivers in Burma; the Ping River in Thailand; the Brahmaputra, Mahanadi, Godavari, Narbade and Ganges Rivers in India; and the Indus River in West Pakistan. In Southeast Asia there are 9,300 miles of rivers suitable for landing the Sea Mistress.[19] However, many of these rivers fluctuate considerably in width and depth as the seasons change. Throughout this entire region there are only 90 lakes that meet the conservative criteria established for Sea Mistress landing areas. Most of these lakes are concentrated in Eastern China along the Yangtze River, in Southwestern China, and in Southern India. In comparison with Europe, Southeast Asia has relatively few landing areas that will accommodate the Sea Mistress.

This relative paucity of landing sites results in several extensive areas being outside the striking range of forces landed by large seaplanes. Almost 20 percent of the land area of Southeast Asia is more than 100 miles from Sea Mistress landing sites. However, a closer examination shows that every capital, every large seaport and every major communications center except Lahore in West Pakistan is within 100 miles of a potential landing area. Also in this zone is every strategic locality of primary significance—the Burma Road, the Great Gorge of China and major passes into the Indus and Ganges Plains.

Lakes of Southeast Asia Three Miles or More in Length

Burma	**4**
China	**47**
India and Pakistan	**31**
Laos, Vietnam and Cambodia	**4**
Thailand	**4**
Total	**90**

Deposits of critical minerals in Southeast Asia are even more accessible from landing sites than are those of Europe. Important deposits of tungsten exist in southern China, Thailand and Burma; tin in Burma, Thailand, Malaya, Laos, Vietnam and China; manganese in India, Thailand and Malaya; and chromite in India and West Pakistan.[20] Every one of these deposits except a chromite source in West Pakistan is within 100 miles of a potential Sea Mistress landing site.

Because of the location of possible military targets in relation to adequate seaplane landing sites, the Sea Mistress concept is as valid in Southeast Asia as it is in Europe.

Even using the most conservative criteria for the selection of landing sites, the geographic validity of the Sea Mistress concept is unquestionable! In the two vital regions selected for study, coastal areas, rivers and lakes provide hundreds of suitable landing areas. Modern military forces landed at these sites could strike nearly every capital, seaport, communications center, key terrain feature and source of strategic minerals in both Europe and Southeast Asia. Furthermore, the runways used by water-based transports are ideal for military operations. They abound throughout the world and do not cost a cent. As Major General Paul F. Yount, former Army Chief of Transportation, stated during a recent speech: "Water borne aircraft land where the Lord has provided us, and these runways cannot be destroyed."

Footnotes

[1] Evert Clark, "Logistic Concept Built on Sea Mistress," *Aviation Week*, Vol 67, Nr 11 (16 September 1957), p 53.
[2] *Ibid*, p 53.
[3] *Ibid*, p 57.
[4] *Summary of Water-Basing Potential for Large Aircraft in Europe and in Southeast Asia*, Martin Engineering Report ER-8243 (CONFIDENTIAL) (Baltimore, Md., The Martin Company, 1956), p 4. (Information extracted from this document is unclassified; and authority has been obtained from the originator, Mr. Guy Mallery, to use the information.)
[5] *Ibid*, p 4.
[6] Clark, *op cit*, p 57.
[7] Correspondence between the author and Mr. Guy Mallery, Project Engineer, Advance Design Section, The Martin Company, Baltimore, Md.
[8] Clark, *op cit*, p 53.
[9] Correspondence, *op cit*.
[10] *Summary of Water-Basing Potential for Large Aircraft in Europe and Southeast Asia, op cit*, p 4.
[11] James E. Preston, *An Outline of Geography* (Boston, Mass., Ginn and Company, 1935), p 405.
[12] L. Dudley Stamp and George H. T. Kimble, *The World—A General Geography* (New York, N. Y., Longmans, Green and Company, 1945), p 365.
[13] *Water-Basing Potential for Large Aircraft in Europe*, Martin Engineering Report ER-8241 (Confidential) (Baltimore, Md., The Martin Company, 1956), p 7-8. (Information extracted from this document is unclassified; and authority has been obtained from the originator, Mr. Guy Mallery, to use the information.)
[14] *Ibid, passim*.
[15] *Readings in Military Geography* (Fort Leavenworth, Kansas, U. S. Army Command and General Staff College, 1957), p 18.7.
[16] J. Paul Goode, *Goode's World Atlas* (Chicago, Ill., Rand, McNally and Company, 1957), p 38.
[17] Stamp, *op cit.*, p 530.
[18] *Water-Basing Potential for Large Aircraft in Southeast Asia*, Martin Engineering Report ER-8242 (Confidential) (Baltimore, Md., The Martin Company, 1956), p 7-8. (Information extracted from this document is unclassified; and authority has been obtained from the originator, Mr. Guy Mallery, to use the information.)
[19] *Ibid, passim*.
[20] Goode, *op cit.*, p 38.

STRAC

By COLONEL VERNON R. RAWIE

Since its inception the Strategic Army Corps has become one of the most important organizations in the United States Army. The necessities for the existence of this "fire brigade" force are well delineated by the author. The Honorable Carl T. Curtis, Junior Senator from the State of Nebraska, thought so highly of this article that he had it printed in the CONGRESSIONAL RECORD.

WILL Rogers stated "Everybody is ignorant; only in different subjects." It appears we Americans, too, are having trouble today understanding the need for a strong and virile United States Army. The conflicting views expressed in the press, radio and TV by senior representatives of our country concerning national defense requirements and strengths has naturally caused the average citizen to ask "Who am I to believe?" For example, are we ahead, or behind, the Soviets in missilery? Are we militarily inferior to the Soviets? Do we need to train more scientists? Is it true the next war will be of such short duration that ground forces are obsolete?

COLONEL VERNON R. RAWIE, Artillery, was commissioned in the Regular Army in 1939. He served in Europe during World War II with the 1st Infantry Division, fighting through the Algerian, Moroccan, and Tunisian campaigns in 1942. In 1943 he commanded an Artillery Battalion, 1st Infantry Division, as they landed ashore on Omaha Beach. He campaigned for 21 months during the Korean War. He is presently Professor of Military Science and Tactics, University of Nebraska, Lincoln, Nebraska.

Again, today, the eyes of our nation are focused upon our Armed Forces with an intensity that is demonstrated in times of great peril. Pearl Harbor was one of the blackest days in our history—but I wonder if future history will not look back at these present hours and term them even blacker than Pearl Harbor?

I wonder if we ourselves do recognize these days as days of our greatest peril?

The Communist goal of world domination has been too bluntly stated, and too often reiterated by the present leaders of the Communist conspiracy, for any of us to retain illusions about the reality of our danger. Can we disregard the indisputable fact that day by day Communist military power dedicated to our destruction is growing ominously on the ground, under the sea and in the air? No American can have the slightest doubt that we have been selected as the Communist main target. Soviet Russia, as the leader of the Communist world, has announced its intentions concerning the fate of the United States and the Free World—our destruction, through any means whatsoever, and the complete control of world societies.

The Communists know that if they could defeat America by either military force, or by their insidious ideology, they could end all effective resistance everywhere else to their plans to capture the world for Communism. Political, economic and cultural strife backed up by military force; and similar forms of limited aggression are all down in the Soviets' book as very practical methods by which they might achieve their aims without ever challenging our nuclear retaliatory power.

Nuclear power—our newspapers, periodicals, radio and TV are free of comment concerning nuclear power—both ours and the Soviets'. I should like to recapitulate for you, at this point, a few thoughts on nuclear power.

With the development of atomic energy and the perfection of guided missiles, we have in our arsenal today what is popularly known as "massive deterrence." This, of course,

means that with our stockpile of nuclear weapons and a swift and sure delivery system made up of the Strategic Air Command and of our Intermediate Range and Inter-Continental Ballistic Missiles, we have the capability to destroy any nation which might attack us.

This retaliation capability is only a portion of our total deterrence, however, against thermonuclear attack upon the United States. An appreciable deterrent force also is the capability of our states and local communities to minimize damage from nuclear attack—that is, our Civil Defense capability. And, of course, a third very potent deterrent is our growing Nike Missile System, designed to knock down a single plane or fleets of bombers long before they reach their targets.

More emphasis is needed in this area if we are to provide adequate protection to the entire nation in time! Also, more emphasis is needed to insure that the Army's anti-missile missile, Nike-Zeus, is ready *in time!*

But Soviet Russia, the leader of the international Communist conspiracy, also has comparable weapons and a delivery system comparable to SAC. At first glance, we *both* have the capability of destroying each other, the result should deter the Communist world from aggression against the Free World.

As a soldier, I heartily endorse the concept of "massive deterrence." Without it, we would be sitting ducks. But has this deterrent power of ours *really* prevented the march of Communism? You need but to glance at your daily newspapers or tune in to your favorite radio or TV news programs to realize that it has not.

The pattern of Soviet aggression has been too well demonstrated and should impress Americans that something more is required if we are to avoid piecemeal defeat time after time. At the conclusion of World War II in 1945, America had every right to assume the Soviets would continue to be our Allies. An American citizen could visit any part of the world and he was received with friendliness and prestige. Can you do this today—only 13 years later? No you cannot! The Soviet strategy is spelled out for us. All we have to do is read it. In 1948, after a few years of "peace" to lull Americans asleep, the Soviets applied political and economic force backed up by military threat by blockading Berlin. Many futile diplomatic attempts were made but finally we had to respond with counter military force. This was followed by another short period of "peace and light" and in 1950 the Korean War was thrust upon us. The Geneva Conference followed and again we believed we could honestly deal with the Kremlin leaders. And then in 1955 the bubble broke once more with the ruthless subjugation of Hungary. In 1956 and 1957 it was "peaceful coexistence" and "competitive coexistence;" and once more many Americans could not understand why our leaders did not sit down at a conference table with the Soviets. This masquerade was terminated with the shocking execution of Imre Nagy, the troubled Middle East and the Formosan situations. In all the post World War II years the Soviets have used the same strategy over and over—a period of "peace and light"—long enough to lull Americans into complacency—followed by political, economic and psychological thrusts backed by military might—followed by another period of "peace" to lull us asleep once more.

Also, we of the Free World do not intend to use our nuclear weapons and positive delivery systems in an unthinking and foolhardy manner . . . I need but to remind you of Korea, Hungary and Lebanon.

In short, indiscriminate use of nuclear weapons will not make the job of war any easier . . . in getting an enemy sniper out of a church steeple, we do not intend to blow up the bishop and the entire diocese.

With the advent of nuclear weapons, the types of warfare which could now occur have undergone a "philosophical reshuffling." That is, our concept of total or unlimited war is now quite different from what it was during World Wars I and II, from both a military and an economic viewpoint. For example, while poison gas was available to both sides during those wars, it was not used except on rare occasions. Also, the delivery systems available were not capable of bringing this destructive weapon to all human and animal beings in Midwest America or Central Europe. And poison gas, while it could contaminate installations, could not destroy them. Also, the entire economic machinery of *neither* side was totally affected.

Consider, then what the effect would be today if both the United States, representing the Free World, and the Soviet Union, leader of the Red Bloc, were to unleash nuclear warfare upon each other. Entire cities and vast segments of human and animal population would be wiped out, and it is possible that both countries would be contaminated for years to come if "dirty" atomic, H- and Cobalt bombs were indiscriminately used. This would be *total war* today, a *general all-out war.*

But the West realizes—and we most certainly hope that the Reds realize, also—that a general all-out war could not possibly result in a victory for either side. Total war today would have only two losers. With this pretty much of an obvious fact, even to men who desire to control the world, it does not appear that *total or unlimited war* will be the method chosen to conquer the world.

In view of this logic, what is the position of the Soviet Union? In all the writings and policies of Communism, especially since that disease conquered Russia from the Tsar, complete conquest of the world has been the guiding light for Communism—*unlimited political objectives.*

Political objectives have always determined the amount of military force which would be applied. In World War II, the Allies had the *unlimited political objective* of beating Germany to her knees—that we did through *unlimited military force,* with the exception of such horror weapons as poison gas, germ warfare and the like.

Today, however, is another era in the history of mankind, and in view of the almost certain destruction of both the West and Communism in the event of an *unlimited general war, total war* does not appear to be the *most likely threat,* although it presents the *gravest danger.*

Although Communism today is making great gains through indirect aggression, especially in the Middle East, it is only normal to assume that one day the Free World shall say: "Stop! Beyond this point you will not transgress!" And if we are firm in our resolve, and are prepared to fight if need be, what recourse will be left to Communism if it cannot pursue its

unlimited political objectives through *cold war* activities and realizes the utter folly of a *general nuclear war?*

Will Soviet Russia throw her unlimited political objectives out the window, and settle for something much less? No, she will not—her very existence is based upon complete subjugation of the entire world.

Between the two extremes of cold war and total war there is only one other way a nation can apply force to gain political objectives—the employment of measured firepower under conditions which are manageable and which permit negotiation, retreat, termination or armistice—in short, *limited war.*

This is the *most likely* manner by which Communism, led by Soviet Russia, will attempt to gain its unlimited political goal, world conquest —through a series of limited objectives, gained by force applied in a series of *limited wars.*

It would be complete folly for us to feel secure because we have the ability to deter the Soviets from a general nuclear war, if at the same time we left them free to pursue a policy of piecemeal conquest. The idea we can safely concentrate our efforts solely upon weapons, equipment and strategy suited primarily for fighting the "big war"—is completely unsound.

The recent Rockefeller Report says —"It is therefore crucial to develop a notion of adequacy for each military mission so that we do not drain resources from some vital task by maintaining an excessive capacity in others."

David Lawrence, in an editorial entitled, "Illusions of 1922 and 1956," published in the *U. S. News and World Report,* noted the similarity in arguments in both those years that war was a thing of the past, because gas was the deterrent in 1922 (or so ran the argument), while nuclear weapons are supposedly the deterrent of today. He then asked the questions:

"Will history repeat itself? We are being told that there will be no war because neither side will venture to use H-bombs. But if war breaks out and no super-bombs are used, who will win that war?"

Well, the H-bomb is certainly not deterring Soviet Russia's war plans. In this day of nominal peace, Russia itself has 175 ground divisions in an active status. Add to this force, the divisions of other members of the Communist bloc, and the Red armies total more than 4500 ground divisions! Communist aircraft number more than 25,000 and she is building her submarine fleet to where it now numbers more than 500! Communisms' armed forces today—ground forces *only*—total *more* than the forces of Germany, Austria and Italy at their peak during World War II.

The United States Army today has fewer than *19 divisions in being!*

It is not my wish to be accused of interservice rivalry—but I state the simple fact that by air or sea, whatever is done forward of the leading ground elements, will only soften or ultimately paralyze enemy resistance, but it carries no permanent extension of sovereign power with it, any more than does artillery fire or an ICBM. The will of the people of the United States can only be expressed, administered and policed as far from Washington as the furthest foxhole has been dug and held. No land is conquered until the ground soldier plants his muddy GI boot upon the enemy homeland and holds it. That the Communists are developing and improving their ground forces today verifies that they hold the same ideas.

Of the divisions we have in an active status today, five divisions and four regiments are in Europe, two divisions are in the Far East; one division is in the Pacific, two infantry battle groups are in Alaska; and one infantry battle group is in the Caribbean area. The bulk of our remaining Army forces are in the United States.

Our overseas divisions are in their present locations because our strategy needs them there. It is not our intention to pull out our European divisions in the event of hostilities in Bongo-Bongo land; we have no assurance that the Soviets and East German armies would not move in immediately into the areas of West Germany that we had vacated. The same holds true for Korea—you can well imagine what would happen in that unhappy land if we were to remove our divisions from there. The presence of our ground soldiers in these areas in the front line of defense of the United States, where the U. S. soldier is presented as the first barrier to aggression, is proof in an unmistakable manner that we mean business, and that we *will not* tolerate aggression in those areas.

Because of such situations, and because we cannot hope to match the overwhelming Communist ground forces manpower, we have decided upon a strategy that is divided generally into two major concepts:—One, is to develop the armies of the Free World through our Military Assistance Program. We furnish money, military guidance and equipment to those nations which request our aid. For example, Turkey. We furnish that brave nation with certain arms, with technological assistance in the forms of advice and schooling, with money to help her feed her troops and build military installations.

Turkey, for her part, furnishes the Free World with some of the best fighting men the world has ever known—men who *will* fight for freedom, men who *have* fought for freedom many times, men who have licked the Russians *every time!*

The second part of our strategy in the face of Communism's human seas of manpower and equipment has been to create a mobile reserve in this Nation—a Strategic Army Corps, called STRAC—which can move on a few hours' notice to trouble spots anywhere in the world. This STRAC of ours is composed of four famous Army divisions, all organized in the pentomic concept. They are: The 101st and 82d Airborne Divisions, stationed at Fort Campbell, Kentucky, and Fort Bragg, North Carolina, and the 1st and 4th Infantry Divisions, at Fort Riley, Kansas, and Fort Lewis, Washington.

They have tremendous striking power, ranging from the bayonet to Honest John missiles, which, of course, have atomic capability. STRAC headquarters organization is provided by Headquarters, XVIII Airborne Corps, Fort Bragg. The slogan of STRAC is: "Skilled, Tough, Ready Around the Clock."

This slogan contains more than appears at first glance:—These divisions are SKILLED in all crafts of war, including the most modern weapons; they are TOUGH, trained to use bayonet, rifle and atomic missiles—the initial elements are continually on the alert; these famous divisions are ready to move in a matter of hours with guns, vehicles and missiles, to a departure airfield or port of embarka-

SKILLED

in all the crafts of war, men of the Strategic Army Corps practice constantly the many and diversified duties of a modern soldier utilizing the latest weapons, welded together in a

TOUGH

organization, trained to strike with bayonet, rifle or atomic missile. Composing the "fire brigade" of the Army, with initial elements continually on the alert and

READY

to move in a matter of hours with guns, vehicles and missiles to a departure airfield or port of embarkation, these men and units are poised to strike, where, when and if needed anywhere

AROUND the

globe; and just as speed adds to the penetrability of a projectile, STRAC utilizes laws of kinetic energy to enhance its striking power, to gain initial advantage in the crucial battle against space, time and the enemy, so that whenever the

CLOCK

of destiny strikes, it will find battle-ready forces capable of turning the tide of battle in a limited war operation, or blunting a massive general attack, should the situation require it.

Army Information Digest

---

tion. The men are ready to strike anywhere AROUND the globe. And when the CLOCK of destiny turns, it will find battle-ready ground forces capable of turning the tide of battle in a limited war operation, or blunting a massive general attack, should the situation require it.

When and if STRAC moves out, it is backed up by the STRAC Reinforcement, the National Guard and Reserve divisions. But it is STRAC itself of which I wish to speak. . . . .

This Strategic Army Corps of ours, and yours, is the "fire brigade" of the Army. It is a balanced force, with supporting units which give it staying power; it has the ability, as do *all* Army forces, to sustain itself in extended ground combat. And because it is armed with weapons from the bayonet to the atomic warhead, *it can apply that measured, sustained degree of force appropriate to the threat* —which thus can best avoid the risk of an all-out nuclear war.

But above all, STRAC is a *ready force*. In these times, readiness to combat aggression is particularly vital to national security, for speed of reaction is a key factor in coping with brush-fire war.

STRAC has one prime prerequisite which the Army itself cannot provide: —it needs suitable transportation for strategic mobility. Under the present organization of our Armed Forces, the Army does not have organic transportation means for rapid, long-range movement of Army forces. The Army must therefore "hitch-hike" with the other military services; in other words, the Army's fire brigade is dependent upon its sister services to get to the fire. In brief, STRAC is a tangible and positive factor which any enemy must consider seriously in the formulation of his war plans. With its mobility and tremendous striking power, it is an important element of strength in carrying out the Army's role in deterring, or if need be winning, a limited war.

Strategic mobility . . . as I use the phrase, means the ability to move military forces rapidly over great distances, together with their equipment, supplies and service support. Speed of military forces is a principal factor in strategic mobility. And because military forces require vast tonnages of equipment and supplies for sustained operations, timely efficient movement of these tonnages is another essential factor in strategic mobility.

It would appear that these two factors, speed and vast tonnages, are diametrically opposed; that no one means of transportation can accomplish both. To a degree, this is indeed the case. At the present time, and in the foreseeable future, the airplane is our most rapid means of transportation, while the ship can carry the largest load.

The Army requires a combination of airlift and sea-lift to attain strategic mobility. Note that I have said "airlift and sea-lift," instead of "long-range-aircraft" and "ships." The question is not merely the number of vehicles, but rather cargo capacity and how many trips can be made and how fast these trips can be accomplished.

Based upon the study of many possible situations, the Army is *convinced*

that strong ground forces will be needed to cope with limited aggression. The division is the smallest unit we have which is capable of the necessary self-sufficiency and staying power in combat. If our Allies are attacked, or if war breaks out again in Korea, we must reinforce these areas with our divisions. If we are faced with aggression in other areas in spite of all that can be done to prevent it short of appeasement, we *must respond* with suitable ground combat forces—and we must respond in *hours and days*, rather than months.

The Army is making great strides in streamlining its combat forces. Unit weights have been reduced while striking power has been increased. For example, the pentomic division weighs less than *one-half* as much as its World War II counterpart. The fighting elements of the division, with supplies and equipment, now weigh approximately 7,000 tons, with no lessening of firepower.

In active combat operations, divisions consume vast quantities of supplies—a unit may expend more than its own weight in supplies in a month of fighting. In the event the Army should be moved to fight in Korea, no supplies from America would be needed during the first weeks of operation. But if the Army were to fight in most other areas of the world, the supplies and logistic elements must accompany the combat units. Thus, it can be seen that the lift requirements for a force vary widely.

The airborne division is designed for tactical airborne assault operations, but it is also ideally suited for strategic or long-distance air movement. An airborne division might well be the initial combat element committed in a limited war.

The flying time from Fort Campbell, Kentucky, the home of the 101st Airborne Division, varies from 13 hours to Alaska to 45 hours to Indo-China. A ready-to-go division can have combat-ready soldiers at a departure field in a few hours' time.

Allowing for ground and air movement, a reasonable objective would be to have the first Army green uniforms appear in an objective area within two or three days and for the first unit, at least a battle group, to be in the area on the third or fourth day. The airlifted force must have supplies and logistical support and, if these are not available in the area, they must be airlifted until such time as surface communications can be established. Additional divisions may, and usually will, be required as promptly as possible. Initial elements of these divisions will also require aircraft.

Army airlift requirements for limited war can be summarized as that lift necessary to have initial combat troops in the area in a matter of hours or days, to transport a strong force which may have to be as large as one half of STRAC to an objective area within a very few weeks and to support that force until surface ships can take over this task.

The Army is convinced that strong combat forces should at all times be ready to cope on the ground with limited aggression. The risk in not winning promptly is too great to take, for it *could* result in expanding operations, possibly in an all-out nuclear war. In many countries facing the Iron and Bamboo Curtains, the Army has combat forces always ready to fight alongside their local allies; but if they were attacked these forces would have to be augmented in a hurry.

Or, aggression may come in areas where there are no United States combat troops. And I repeat, if aggression comes, how long should it take us to get fighting men to the scene? A ready-to-go division in the United States can have combat soldiers at a departure airfield in a few hours. The United States should be able to airlift a decisive limited war force to any place in the world within four or five days.

This kind of essential mobility requires adequate airlift to start with, and modern sea-lift to sustain. But there is an alarming lack of modernization in our troop-and-supply carrying airfleet. Development of modernized planes and ships is outside the Army's sphere of activity, but in view of the importance of mobility, the Army thinks it necessary to have sufficient facilities for moving troops and supplies swiftly wherever aggression appears.

You will note when the crisis in Lebanon erupted during the middle of July, it was the troops of the Army's 24th Division in Germany which were airlifted to Lebanon—*not* troops from our Strategic Army Corps in America—these troops, of course, were in addition to the United States Marines who were aboard the Sixth Fleet. That our STRAC Forces in the United States *were* ready to go was evidenced only a few days prior to the Lebanese crisis when airborne troops were airlifted to the Caribbean during the Vice President's tour in South America. The movement of troops from one critical area to reinforce another critical area *is not* in keeping with our Nation's strategy. The Army's STRAC Force *is* ready to go—but where we fall short is in the matter of *transportation*. To summarize:

1. We now have and certainly need three deterrents to unlimited war—the Nike System (not yet completely installed), our Civil Defense capability, and our Strategic Air Command. While these are obviously working, since we have not had a nuclear attack on the United States, *more emphasis* is needed on the first two—Nike System and Civil Defense.
2. We must be capable of deterring limited war, or winning it if deterrence fails, else the Free World is nibbled away until we stand alone.
3. We have STRAC Army divisions ready to go, but the conveyances are not at hand nor in sight. Modern sea and airlift *must* be provided as a matter of urgency.

In closing, I should like to quote from Mr. Robert Endicott Osgood's book, *Limited War, The Challenge to American Strategy:*

". . . Preparation for *limited war* is as vital to American security as preparation for total war. It is a matter for thorough and systematic planning, not for improvisation. After all, in developing our capacity for total war, we are preparing for the *least likely contingency;* its principal justification lies in the fact that it may never be used. But in developing a capacity for limited war, we would be preparing to meet the *most likely contingency;* we would be maintaining the only credible deterrent to Communist advances in the most vulnerable areas of the world."

The Army can ill afford to say that the job is done when, once trained, an individual does a specific job. By raising the educational level of personnel, their efficiency and productivity will rise proportionately.

(U. S. Army)

Education and the Soldier

IT has been said that the majority of problems in the Army today are centered around the individual. Among these is that of raising the educational level of our career personnel to meet the increased demands of modern warfare.

There are few organizations that have undergone as striking and far-reaching a transformation in recent years as the United States Army. Within the brief span of 10 to 15 years, the Army has shed the World War II concepts of organization and deployment and developed new weapons and equipment to meet the demands of nuclear or limited war with increased firepower and strategic and tactical mobility. Yet the final and decisive element in warfare today, as in the past, is not the weapons, equipment, organizational structure, or concepts, but the individual soldier.

With the advent of nuclear warfare and mechanization changing the concept of masses of men to one of dispersion and mobility, the requirements for leaders, both officers and noncommissioned officers, become more and more complex. The type of individual the Army must have—one who survives, and contributes, and wins on the battlefield—is the individual whose vision, training and education equip him for varied tasks in a diversified and changing Army.

Yet there are those in the Army today who insist they do not need to improve themselves educationally because they are "militarily" qualified to perform their present job. This is a near-sighted argument and one which reflects laziness on the part of the individual.

True, not all good noncommissioned officers are high school graduates nor are all good officers college graduates. There are some of meager education who are first-rate leaders or one-job specialists. But the performance potential of these men, and therefore of their units, is limited by the simple fact that they cannot qualify for higher or critical jobs or grow much above their present level. In down-to-earth terms, would a platoon sergeant be able to adapt quickly to the additional responsibility of company commander if the emergencies of war placed him in that position?

"The soldier whose mind is kept alert by intellectual exercises will be

Editor's Note: This article was written by the Education Officer at the U. S. Army Training Center, Armor at Fort Knox, Kentucky and reflects the views of many individuals in the Training Center regarding the need for raising the educational level of Army personnel.

the stronger practical man," Elihu Root, noted American educator once said. The Army can ill afford to say that the job is done when, once trained, an individual does a specific job with minimum effectiveness. With limited manpower, it is essential that the full capacity of the individual be determined, developed and utilized. By raising the educational level of career personnel, their efficiency and productivity will rise proportionately.

How does formal education—study in mathematics, language, science and the arts—increase the soldier's efficiency and potential? The educational process can be likened to the old-fashioned *whetstone* used by our fathers to sharpen axe-blades and other cutting tools. It would be foolish to attempt to cut wood with a dull axe-blade because of the reduced efficiency of the tool. The *whetstone* was used to sharpen the blade, thus increasing its cutting power. So it is with education. It sharpens the individual's mind and reasoning faculties by training him to think faster and more accurately.

An education not only provides an individual with knowledge of how to accomplish certain tasks, but it provides exercise for the *muscles* of his brain, and a base of knowledge which enables him to develop ways and means of accomplishing new tasks, or of improving on methods of accomplishing old tasks. It is these latter accomplishments which make an education so valuable . . . and particularly today when so many new problems are arising which need solutions.

If a man cannot express his thoughts to others, he is a prisoner; and he can achieve freedom only by developing his powers of expression through education. For thoughts are developed by words; and if the man lacks the necessary words, no amount of innate knowledge will be of help to him. He may be a capable leader, but neither his followers nor his superiors will be able to recognize that fact.

This is not to say that World War II did not require a thinking soldier. The soldier of World War II established beyond a doubt his reputation as the best fighting man in the world. However, we cannot win future wars on our laurels; or, as General Douglas MacArthur said, "Wars are never won in the past."

As has been emphasized many times before, modern warfare demands more of the soldier. Whether he is a squad leader or battle group commander he will still be faced with new and more complex problems and emergencies which will demand quick, mature decisions. Present and future military requirements call for mature, flexible men, capable of quick and responsive understanding.

The Army has recognized, for some time, the growing needs for higher education among its personnel. As a result, it has provided the necessary facilities, incentives and guidance for resuming and continuing their general education in Army Education Centers and civilian institutions. Increased emphasis is being placed on officers and enlisted personnel to achieve the minimum educational levels the Army desires. And as the educational level of the Army is raised, it is foreseeable that the requirements for promotions will be raised correspondingly. Thus we see that the Army has met the needs of its personnel in the area of formal education.

We are giving the educational program our support but not to the extent that it can be said we are giving it our full support to utilize all the capabilities of the General Educational Development Program. Like any other program, the success of GED depends on the amount of interest and command support given at all levels of command. Even though we are in a constantly changing period, the need for the old-fashioned *kick-in-the-pants* form of command support remains the same.

To show the importance of command support in the field of education, let us review the situation in the U. S. Army Training Center, Armor, at Fort Knox, Kentucky. In August, 1957, over 850 enlisted men in grades E-4 through E-7 had not completed their high school education.

To meet the obvious need for improving this situation, a widespread publicity program was initiated which emphasized three points:

1. The importance of education to the soldier.
2. The individual was, in effect, *cutting his own throat* promotion-wise and career-wise by not enrolling in the education program.
3. Individuals in the command would not be considered for promotion and assignments to positions of increased responsibility who were not actively working on improving themselves by participating in the education program.

Continuing emphasis and interest were placed on the program during the following months. Recent reports indicate a reasonable amount of success has been achieved.

The original number of enlisted men (E-4 through E-7) below the high school level has dropped to slightly over 300. The task is far from finished. Nor will it be completed until every NCO has achieved a high school education and every officer has received his baccalaureate degree.

This example is cited for two reasons. First, it demonstrates the need for command support in raising the educational level of the soldier. Second, it shows conclusively that when the soldier is properly informed of and understands the reasons for achieving a higher education, he will set to work to achieve that education, despite the extra work and sacrifice.

The solution to the problem of raising the educational level of military personnel is for officers to set the example and also to encourage enlisted personnel to raise their educational level in order that they might take on higher responsibilities. The Army's educational services have not been made available to inconvenience commanders or their officers, but rather to assist them in the accomplishment of their training and operational objectives.

The extent of the General Educational Development pay-off derives directly from the commander's interest in the development of personnel. When commanders utilize the Army's educational services as they are designed to be used, the GED pay-off is in terms of improvement in the abilities of junior officers and noncoms to manage men and conduct training and in the strengthened capacities of officers and enlisted men to absorb and apply the kind of leadership, tactical and technical information which becomes increasingly important to the Army in assuring success in future military operations.

Mobile warfare demands a closer look at all of today's resupply techniques. Outmoded doctrine, geared to a semi-fixed field army, must give way to modern logical thinking.

Logistical Training

By CAPTAIN EDWARD L. WAGGENER

THE new armored division tables of organization provide necessary equipment to accomplish missions assigned, yet the equipment alone is not sufficient. The missing element is a human one—trained personnel. Personnel, both officers and enlisted men, trained in the use of new equipment, and trained in the tactics of resupply mandated by the concept of mobile warfare are a prime prerequisite for successful operations.

The doctrine of flexible warfare as taught today demands that each person involved be a logistician. An interested commander can ensure that training schedules provide enough leeway to stress logistical training in a manner that all will appreciate the importance of logistics. Training in logistics should, to all intents, be granted equality with tactics.

Mobile warfare demands a closer look at all of today's resupply techniques. Outmoded doctrine, geared to a semi-fixed field army, must give way to modern logical thinking. Training in logistics should not be limited to the *broad brush treatment* and cannot be limited to classroom instruction for the benefit of enlisted personnel alone. All officers, especially those in grades susceptible to assignment to logistical positions as battalion and division S4's or G4's, should receive intensive training in all aspects of resupply. Commanders at all levels should drop the common practice of assigning an outstanding company or battalion commander to a logistical vacancy solely

(U. S. Army)

Bulk operation creates new doctrine both at unit and Quartermaster level.

CAPTAIN EDWARD L. WAGGENER, Armor, served in Europe during World War II with the 20th Armored Division. Subsequently he reverted to civilian status. Recalled in 1951 he was assigned to the G4 Section, 2d Armored Division. He assumed a similar position with the 4th Armored Division. Next he was assigned to the Maintenance Branch, Fort Hood, Texas. He is Advisor, U. S. Army Reserve, Charlotte, N. C.

on the basis of prior performance of duty. Perhaps the outstanding company or battalion commander will be a complete failure as an S4/G4; surely there is no shibboleth that designates a logistical type, yet certain officers possess peculiar talents as logisticians, and these should be searched out and assigned where necessary. Success in the Army's ultimate mission dictates that the most capable man be assigned in each TOE slot; budding logisticians should be kept in logistical positions as much as possible.

Logistical training in the new Armored Division should encompass utilization of the equipment. The addition of bulk gasoline equipment to TOE's is a good example; the bulk operation creates new doctrine, both at unit and Quartermaster level. Class III resupply at unit level during field operations will require very close coordination to ensure maximum utilization of the equipment available. The unit 1200 gallon tanker is an asset when used to its maximum capability; a detriment when improperly used.

Training should include the use of 5,000 gallon tankers assigned to the Quartermaster battalion. Normally these tankers will be restricted to travel between Army and Division Supply Points. Close coordination between the Division Quartermaster and the Army Supply Point will become routine instead of occasional. Frequently the tactical situation will require direct radio liaison between Army and Division Class III installations; the Quartermaster battalion will be required to develop the method.

Shifting of loads in all types of tanker equipment should become a routine habit. Maximum use of all tankers can only be reached when all personnel involved in their use understand that shifting of loads will be necessary at all echelons; particularly in the Combat Command Control Point. The Combat Command S4 must exercise constant supervision of bulk vehicles, even to the point of dispatching individual tankers to the division Supply Point rather than waiting for convoy constitution.

Training for atomic warfare should constantly stress the importance of full vehicle tanks at all times. Such a requirement can only be reached when each individual in the Army establishment has been taught that the vehicle he is concerned with will be "topped-off" with gasoline at any halt, no matter what the time lag or distance since the last halt. The task force or battalion commander with a column on the march to an assembly area should realize, and constantly stress to his subordinates, the hard fact that the intended assembly area could suddenly develop into an attack position or defensive area. The commander without the capability of moving without prior warning is at the complete mercy of a fast moving enemy. When the commander of any type unit dispatches his gasoline vehicles to top-off each vehicle at each halt the training objective will have been reached. Many World War II organizations reached this objective, but generally it has become a lost art.

Training programs should stress the importance of the Division Logistics Operation Center. Training in this installation can well be conducted during garrison operations to indoctrinate personnel with Operations Center functions. Division headquarters logistical people must be capable of instituting more than one Logistics Operations Center when the situation so dictates, and constant practice is the only method that will provide a smooth operation.

Training in the logistical organization for combat must become habitual in order to develop the flexible, independent concept of the armored division to the optimum. Logistical self-sufficiency can only be achieved through a full understanding of the problems and concepts involved. Continued revision of outmoded doctrine at all levels is required.

Hand in hand cooperation between the G3 and G4 should be developed to the maximum. Logistical and tactical concepts become so closely interwoven in mobile warfare that no buffer space is left for divergent paths of operation. The Administrative Order and the Operation Order will require meshing to the last detail; the tactical unit commander has a greater need than ever before for these two publications, especially at the beginning of an operation.

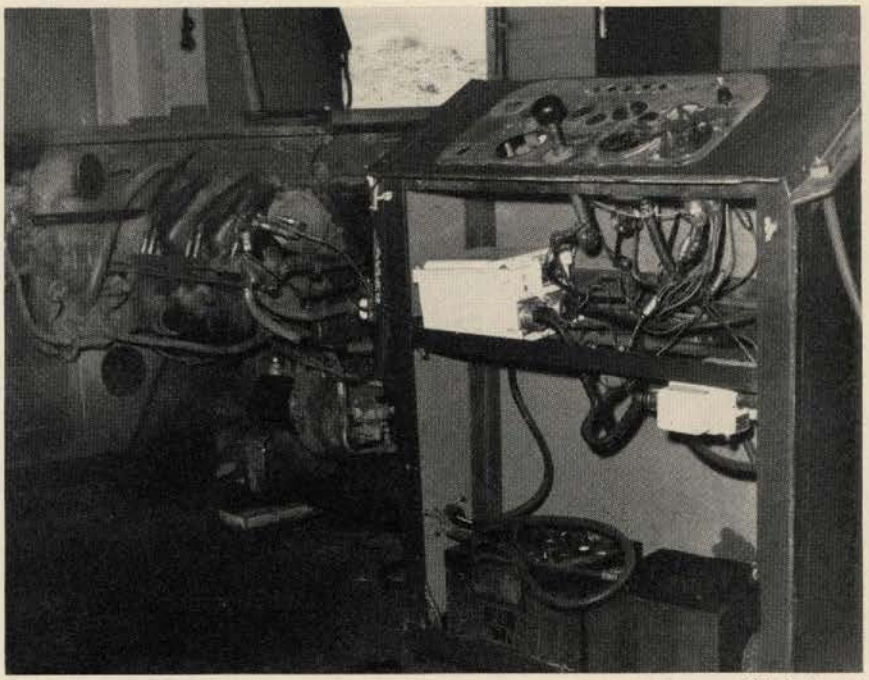
Defense of the division rear area is the joint responsibility of the G3 and the trains commander. The G3 prepares the overall plan and the trains commander implements, yet each commander in the division and his resupply personnel also have a great interest. Training in local protection should be given to all involved personnel.

Protection against surprise guerrilla attack and atomic defensive measures is of paramount importance. The lessons of the Korean action should not be forgotten, the time may come again when vehicle drivers will be required to defend their own convoys.

(U. S. Army)

"Topping off" at each halt is a maximum training objective for the commander.

A Saving in Maintenance Time*



(U. S. Army)

MAINTENANCE time on M48 tank power packs can be halved through use of a remote-control "running stand" designed by technicians of the 3d Armored Division.

The invention is a complete control-panel board that resembles a lecture stand. Instead of placing the power pack alongside the tank hull to wire it to the driver's compartment instrument panel, maintenance men now wheel the unit from engine to engine in a one-man operation.

The power pack can be started, operated and shut off from the panel of the running stand. Built in 40 hours using $100.00 worth of pickup parts—from bed stands to tank salvage—the unit is now in use in the shop of the 32d Armor in Friedberg, Germany.

Other Advantages

Several engines can be placed in the shop together—four have been tested in about 30 minutes—doubling the efficiency of the sections. And the hardship of working outdoors in bad weather is eliminated.

One man is freed for other duties by the manpower-saving unit. Formerly, two men were needed to check out a power pack—one in the driver's compartment and the second at the engine. And in order to observe the instruments during the testing of an engine, the mechanic had to climb in and out of the tank. Now one man can operate the running stand and start the engine at the same time.

Deficiencies of M48 instruments and wiring have been detected—flaws originally diagnosed as power pack malfunctions.

The frame of the stand is built of welded angle iron recovered from unserviceable Army beds. Mounted on the presswood top panel are the control switches and dials that in essence duplicate the driver's compartment control.

The two 12-volt batteries were obtained through normal parts channels as were the generator-regulator, master and starter relays, magneto switch and rectifier.

The voltage regulator was obtained from a unit "Little Joe" (auxiliary engine). All wiring cables and connections were odds and ends gathered in the battalion maintenance shop.

The gas tank (70 gallon capacity) came from a half-track and the instrument panel was salvaged from an M4 tank. The master switch, TAC gas gauge and throttle are also M4 parts.

The portable unit has a slave receptacle facility. After tanking compression tests on three or four engines, the designer explained, the batteries were too weak to start an engine. Now, if the need arises, the operator can slave the running stand or help out an engine with weak batteries.

The left quarter of the instrument panel is blank, as the stand is now utilized. There, warning lights and a switch will be installed to run the auxiliary engine. Other design improvements include mounting a magneto tester on the back of the stand and two vacuum gauges to improve a tune-up job. Two more batteries may be installed.

Other Features

Quick disconnects in the primer system and cable couplings, for swifter hookups; engine temperature and pressure gauges and elimination of hydrostatic lock through use of a primer pump.

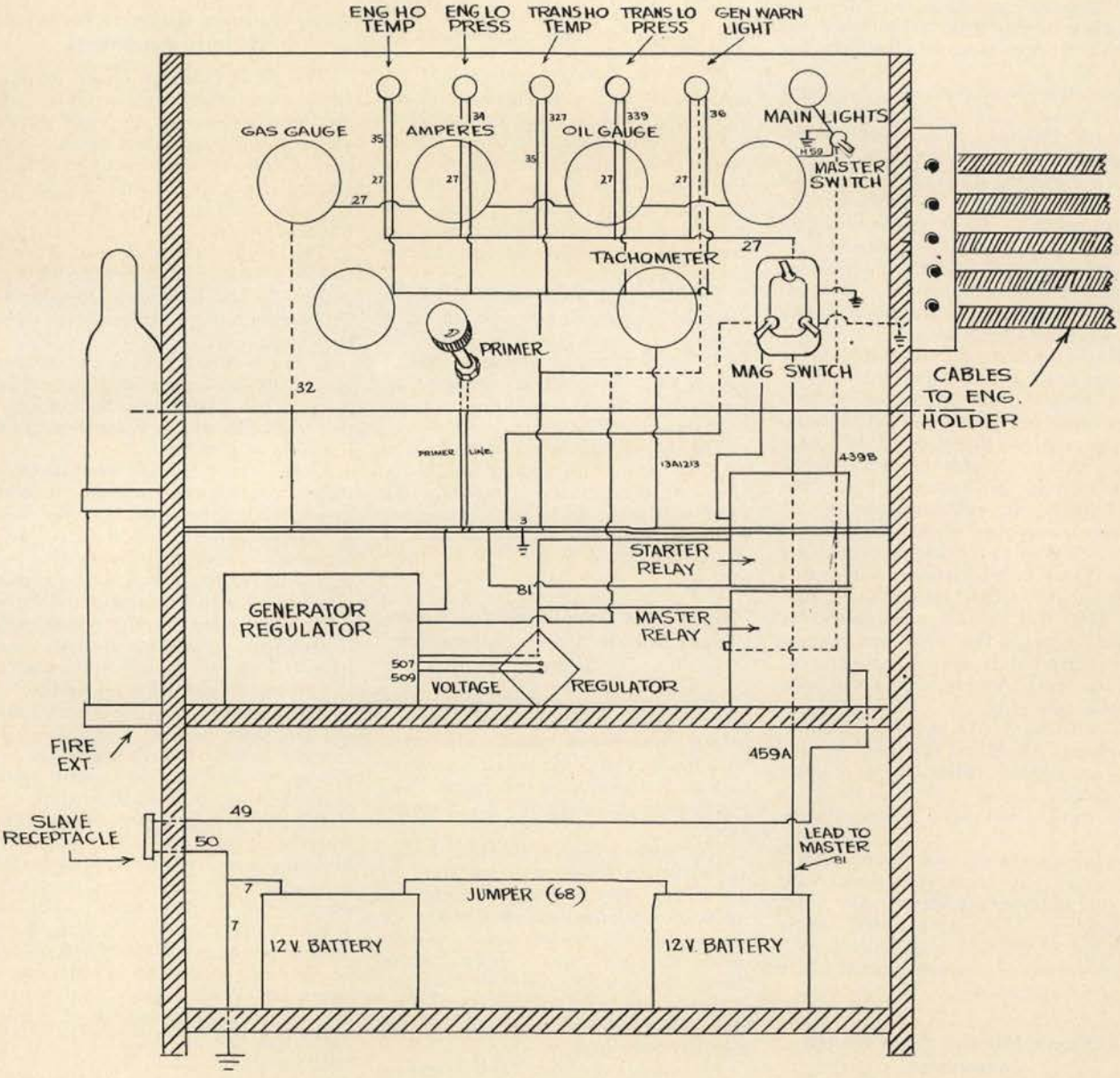
Designer of the device was Sp5 Guy E. Conklin of Headquarters Company, 32d Armor. He conceived the idea, drafted the plans and wired the control panel. Sp5 John R. Reed, also of Headquarters Company, did the welding.

Captain B. D. Fahey, battalion motor officer, who saw to it the necessary parts were secured and who guided the construction, considers the stand an invaluable aid.

"It saves space—it saves time—and increases efficiency. I recommend a similar unit as an item of issue for every battalion-sized unit."

* PIO, 3d Armored Division.

REMOTE CONTROL RUNNING STAND



Shown above is a schematic plan of the remote control running stand for the benefit of any unit which desires to build its own unit.

NEWS NOTES

Army to Order New M60 Tank

The Army plans to order 180 of its new main battle tank, the M60, within the next 60 days, the Department of the Army announced in late March. A rundown of this tank was published in the March-April issue of *ARMOR*. (See page 12.)

The new Diesel-powered 52-ton tank will be assembled at the Army Ordnance, Newark, Delaware, plant over a three-month period in mid-1960.

Because of the small size of the initial order, the M60s will be produced as a continuation of M48 production currently under way by the Chrysler Corporation in the Newark, Delaware, plant. The initial production contract is now in the process of negotiation with the Chrysler Corporation.

When operational, the M60, to be known as the main battle tank, will replace both the present medium 53-ton M48 and heavy 60-ton M103 tanks because its new British-made 105-millimeter gun is capable of defeating all armored vehicles known to exist. The M41 light tank will remain in use for reconnaissance and security missions.

In addition to the heavier armament and Diesel engine which will greatly increase the tank's operational range, the M60 will provide a simplified fire control system. The track and suspension system will be similar to the present medium tank. A crew of four will operate the new tank.

Continental Motors Corporation, Muskegon, Michigan, has been awarded the 3.8 million dollar Army contract for special tooling and equipment for production of the diesel engines for the M60.

While the M60 tank eventually will be procured in larger quantities, plans for this additional production are as yet undecided. The location for future quantity production will depend on a detailed study of cost, transportation and other considerations.

Antitank Missiles from French Government

A letter order has been placed with the French government to produce SS-10 and SS11 antitank guided missiles and associated equipment for the U. S. Army.

A definitive contract is currently being negotiated.

Initial quantities of the missile will be provided Seventh Army troops in Germany.

The SS10 and SS11, manufactured by Nord Aviation of Paris, are remote-control, wire-guided missiles with a solid fuel propellant and are capable of putting out of action any tank known to exist in present day armies.

These missiles can be hand-carried, dropped by parachute from planes, operated by one soldier, and launched from the ground, a vehicle, helicopter or airplane.

The United States government has contributed to the development of the SS11 which, while based on the SS10, is a weapon complementary to it, having greater speed, range and effectiveness. The contribution by the United States was made under the United States Mutual Weapons Development Program, a part of the American foreign military aid program.

The SS10 antitank missile is basically designed for ground forces and is being procured for use by the U. S. Army. The SS11, with a range more than double that of SS10, is somewhat heavier than the SS10 and is being procured for evaluation.

The SS10 has been adopted as a standard item of equipment for U. S. forces. A determination regarding the SS11 will be made following the presently planned program for evaluation of this system.

Night Eyes Developed for Army Tanks Aided Atomic Submarine Skate

New "night eyes" developed for Army tanks—similar to a television camera—helped the Navy's atomic submarine Skate probe a path through the ice in its journey last month to the North Pole, the Department of the Army announced recently.

The super-sensitive viewing device, mounted in a shock-proof container on the Skate, gave the crew inside the submerged submarine a view of the ice above. The submarine made its trip under ice, surfacing at points where there was no ice or relatively thin ice.

It was the first use of the device. Only one prototype viewer of this design has been built.

The viewer was developed primarily for mounting in a tank to permit fire direction against targets at night.

The new equipment has been described as one of the greatest advances in its field, since it has capabilities for night viewing far beyond any previously achieved.

The inter-service cooperation between the Army and Navy during the Skate's polar journey made it possible to evaluate the equipment.

This new device was developed under an extensive Army Ordnance-Industry program involving Frankford Arsenal, Philadelphia, Pennsylvania; Bendix Aviation Corporation and the General Electric Company.

Army National Guard to Perpetuate Historic Regiments

The Army National Guard has started a nation-wide reorganization under the Pentomic concept, and will perpetuate its historic regiments through adoption of the Army's recently established Combat Arms Regimental System (CARS), the Department of the Army announced recently.

The regimental structure of Army combat divisions has given way to battle groups. In the Pentomic Division, five battle groups have replaced the former three regiments.

Conversion to CARS in the National Guard will be accomplished on a State-by-State basis, with each State selecting the regiments whose historic traditions it wishes to preserve.

Under the CARS reorganization, units from separate company to battle group size will be assigned by the States to traditional National Guard "parent regiments" according to geographic location. Each regiment will have a variable number of actively organized member units, depending on the requirements of the Army. It is planned, however, to have at least one battalion-size unit active in each regiment at all times.

The purpose of CARS is to establish, as a long-term measure, a flexible organizational system which maintains continuity of the Nation's most distinguished Army regiments, regardless of changes in tactical organization in peace and war. The system also will assist in building troop *esprit de corps* by making it possible for Guardsmen of the combat arms to identify themselves readily with a historic organization of their locale.

Member units of the regiments will be assigned to a division or other tactical command. Within the Guard, current organizational assignments of tactical units will not be affected by CARS unit redesignations.

As with other Army components reorganized under CARS, the plan covers only units of Armor, Artillery and Infantry. The system may be expanded later to include branches other than the combat arms.

Reorganization has started in more than half of the States and is expected to commence soon in the others.

Miniature Devices Developed

Development of an electric light

slightly larger than a pinhead and a radio transmitter the size of an eraser on a pencil, was announced recently by the Department of the Army.

Both devices were developed by the Diamond Ordnance Fuze Laboratories, Washington, D. C., and received national awards for achievement in the field of miniaturization. This is the second year the Army has been honored in this field which includes competition from civilian industry, educational institutions and other government agencies.

The lamp, one-tenth of an inch long and 3 one-hundredths of an inch in diameter, may be used in many types of dials such as those on control panels in missile research and electric computers. It also may be used in medical endoscopes, in probes for examining cavities in scientific and industrial research, and in optical systems requiring a near-point source of light.

The transmitter is used in ballistic studies. The device determines temperature of an artillery shell while in flight and instantaneously radios the information back to ground receivers.

Trainfire for Reserve Components

Army National Guard and Reserve units will get *Trainfire* training, the Army's revolutionary new method of producing expert combat marksmen. But it will take a little time, according to a directive put out in April by U. S. Continental Army Command headquarters at Fort Monroe, Virginia.

The *Trainfire* system is designed to develop, in minimum time, riflemen who can detect and engage combat targets more effectively than those trained under known-distance marksmanship programs.

It duplicates in training many of the marksmanship problems encountered by individual riflemen in combat. The trainees get combat realism by shooting at human-shaped targets on a course covered with natural terrain growth.

The electrically controlled silhouette target, called "Punchy Pete," pops up unexpectedly for brief intervals, in unpredictable sequence and at various distances from the shooter. When the target is hit, it falls over.

This gives the soldier practical training in delivering quick and accurate fire under conditions he is likely to encounter in combat.

Dependent upon the availability of funds, implementation of the *Trainfire* system for Reserve components is currently scheduled to begin in Fiscal Year 1961 and be completed during FY 1962.

Implementation of *Trainfire* as the primary rifle marksmanship course for Reserve components is not considered feasible at this time due to facilities and training time required, the directive says.

But *Trainfire* with a modified qualification course can be implemented, as facilities become available, by Reserve component units when they are so located as to enable them to use facilities on weekends.

The course will be fired only by Reserve component units who can accomplish the firing during weekend training, and provided qualified instructor personnel are available.

Trainfire will be fired by Reserve component personnel during six months' RFA training when included as part of the regularly scheduled training.

Selected individuals not exceeding five percent of assigned personnel are authorized to fire *Trainfire* during annual active duty for training when facilities are available to provide units with qualified instructors.

This instructor training, says the directive, must not drain units of key officers and NCO's and thereby reduce effectiveness of the unit training program.

Personnel who don't fire *Trainfire* during weekend training or annual active duty training periods will continue to fire the present known-distance marksmanship courses on weekends.

All personnel, the directive states, will fire *Trainfire* upon mobilization.

Three firing courses are included in the program:

1. The 56 hour *Trainfire* Qualification Course for personnel who have not previously qualified on *Trainfire*.
2. The 38 hour *Trainfire* Qualification Course, for personnel holding a previous *Trainfire* qualification.
3. The 16 hour Familiarization Course, for annual familiarization of qualified ARNG and USAR personnel.

Regarding present range construction policy, the directive says that *Trainfire* ranges will be constructed only at active installations and State-owned military camps. Additional construction is planned as equipment is developed which will make it practicable to set up and maintain ranges in areas other than these.

Trainfire is now being put into operation throughout the active Army, with priority going to training centers and Infantry divisions.

First Army Hawk Air Defense Unit

The first Hawk unit, latest in the Army's air defense weapons systems, will be activated at Fort Bliss, Texas, in June, the Department of the Army has announced.

The 5th Missile Battalion, 57th Artillery, composed of approximately 300 officers and men, will be organized to support the U. S. Army Air Defense School in training future Hawk missilemen. The unit will test component equipment of the Hawk system in connection with the school's mission to develop organizational concepts, procedures, tactics and techniques for air defense units.

Hawk units planned for deployment will become operational in the near future. These units are capable of employment either with field armies overseas or for continental defense.

The Hawk, "Homing-All-the-Way-Killer," is specifically designed to search out and kill hostile aircraft or cruise-type (air breathing) missiles from tree top level to medium altitudes. It will destroy missiles traveling at twice the speed of sound at altitudes ranging from "on the deck" to present aircraft operating ceilings.

Unlike the Nike Ajax and Hercules systems, which use "command guidance" determined by computers on the ground and transmitted to missiles in flight, the Hawk uses "homing guidance" to cope with low altitude targets which hope to escape detection by taking advantage of reduced effectiveness of normal radar caused by ground clutter.

Hawk equipment is rugged, compact, mobile and capable of being air transported. The system can engage single, massed or widely separated targets with a high rate of fire. Three 1,250-pound missiles are mounted on the Hawk launcher and six launchers are normally associated with each battery. Full-tracked vehicles are used to transport ready missiles from the battery storage area to assist in reload of the launchers.

Hawk is a supersonic missile powered by a solid rocket propulsion system. It has scored a direct hit on an XQ5 drone traveling at 1,400 miles per hour, at an altitude in excess of 30,000 feet, and has successfully engaged an F80 drone aircraft at tree-top level.

Cold Weather Tests of Hawk Missile

Canadian Army Headquarters and the United States Department of the Army announced recently that a series of cold-weather trials of United States Army guided missiles will be conducted at Fort Churchill, Manitoba, during the winter of 1959-60.

The missile system to be tested is the U. S. Army's supersonic surface-to-air Hawk, continental and field army air defense missile.

A series of cold weather tests on missiles took place at Fort Churchill this winter when the Nike Hercules, another supersonic surface-to-air weapon from the U. S. Army's arsenal, went through a series of trials.

Selected Canadian and U. S. Army personnel trained at the U. S. Army Air Defense Center at Fort Bliss, Texas, and the U. S. Army Artillery and Missile Center, Fort Sill, Oklahoma, will man the weapon and will carry out the trials on a joint basis. Trials will begin towards the end of this year, with firings scheduled through the months of January, February and March, 1960.

The scheduled tests are designed not only to test fire the missile, but to demonstrate the field operation of the complete missile system under cold-weather conditions.

Detailed arrangements for the provision and movement of equipment and missiles, composition and intensive train-

ing of the test teams, provision of launching areas and ranges are now being worked out by the respective armies.

Two Lacrosse Units

The first two units employing the mobile, highly accurate Lacrosse surface-to-surface guided missile will be activated at Fort Sill, Oklahoma, within the next two months.

Scheduled to become active before June 25 are the 5th Missile Battalion, 41st Artillery and the 5th Missile Battalion, 42d Artillery, each with approximately 170 officers and enlisted men.

The solid propellant Lacrosse missile, developed out of experiences of the Pacific campaigns in World War II where it was difficult to get effective hits with artillery on small targets such as caves and bunker entrances, will give the front-line Infantryman a rugged tactical support weapon capable of doing a variety of jobs. It will deliver numerous types of warheads including nuclear and shaped charge with high accuracy up to ranges of conventional artillery.

All components of the Lacrosse system—19-foot missile, launcher, and guidance elements—can be mounted on a standard 2½-ton Army truck. The equipment and crew can also be easily airlifted to battle areas if necessary.

M60 Machine Guns Being Produced

A contract for first commercial production of the new 7.62mm general purpose M60 machine gun has been awarded to the Saco-Lowell Shops, Inc., of Boston, Mass., the Department of the Army has announced.

The $2,700,000 contract, for 5835 machine guns, concurrent spare parts and manufacturing data, will establish a mobilization base for future production of this newly-developed weapon, as well as supplying a portion of the current requirements for this gun.

This production will be in addition to the pilot-line operation now underway at the Springfield, Mass., Armory.

Flying Car and Tank to Be Tested

Flying automobiles and flying military tanks now being developed by two local [Washington, D. C.] companies are expected to be ready for tests within the next few months.

William H. Alper, President of National Research Associate, Inc. of College Park, Md., told the House Committee on Science and Astronautics yesterday that a fullscale, one-ton model of a fiying tank would be ready for evaluation tests this summer. The unit will be capable of traveling 5 feet above land or water at speeds up to 200 miles an hour, he said. The first model will be powered by a 50-horsepower engine.

Flying automobiles and cargo carriers are being developed by a newly-organized Washington company called Spacetronics, Inc. Carl W. Bollum Sr., president, board chairman, and major stockholder of the two-man organization told Committee members Tuesday that a 48-foot-long and 32-foot-wide cargo carrier capable of carrying a load of 40,000 lbs. 30 in. above the surface of land or water also would be ready this summer.

A sports car, 26 feet long and 20 feet wide will be ready late this fall, he said. This vehicle will be capable of carrying 6 passengers and 1000 pounds of baggage at high speeds some 2 feet above land or water. The addition of 7000 more pounds of load would reduce the height of the vehicle only 7 to 8 inches, Bollum added. It will be powered by a large automobile engine and will be capable of speeds over 100 MPH.

* * *

National Research Associates and Spacetronics use large fans or propellers that blow air downward to lift their vehicles off the ground.

In the flying tank, air will be ejected through a circular ring opening under the vehicle. In the flying automobile and cargo carrier, air will be pumped into a large space under the floor of the vehicle building up the pressure and lifting the unit off the ground.
(Courtesy of The Washington Post.)

New Director of R&D, D/A

Appointment of Richard S. Morse as Director of Research and Development of the U. S. Army was announced recently by Secretary of the Army Wilber M. Brucker.

Mr. Morse, founder and president of National Research Corporation, Cambridge, Massachusetts, for 19 years, will take over his new duties June 1. He succeeds Dr. William H. Martin, who has held the Army post since its establishment in 1955 and whose resignation was recently announced.

Mr. Morse will be responsible for supervision of the Army Research and Development Program with authority and responsibility within the field of Research and Development equivalent to an Assistant Secretary of the Army, according to Secretary Brucker.

Television Film Honors the Founder of West Point

Thayer of West Point a "Big Picture" television film portraying the life of the founder of the U. S. Military Academy at West Point, New York, has been released to television stations throughout the United States recently by the Office of the Chief of Information.

The film, narrated by Lowell Thomas, portrays a man of vision facing up to a challenge—to create a military academy truly worthy of the United States Army. Sylvanus Thayer, known as the "Father of West Point," had an excellent background for this assignment, having graduated with top honors from Dartmouth, and was a veteran of the War of 1812.

This film reveals the great influence that Thayer has had upon the men of the Long Gray Line. He saw that determination to defend this land is not enough. Knowledge and training—the full education of the professional soldier, the engineer and, for that matter every American, is the source of our strength as we face the future.

The Big Picture is the most widely distributed and telecast TV series in the world. It is now in its eighth year, having released more than 250 issues.

A Transmission Tester for the M59 Armored Personnel Carrier

One of the most valuable vehicles in the 3d Armored Division's 122d Ordnance Battalion shops doesn't go anywhere at all. In fact, it's bolted fast to the ground.

The static wagon has an M59 engine connected to a jeep axle and grinds away, six days a week, trying to overcome the resistance of two hand brakes. Is this futile? Not at all. The device is used to test rebuilt M59 transmissions under simulated work loads.

The value of the device lies in that it permits testing of transmissions without re-installing them in the Armored Personnel Carrier. This means a saving of mechanic hours, since only ten minutes are needed to install the transmission in the test stand. In addition to giving a positive test of every transmission in each of the gears, the device eliminated the need for working in the cramped corner of the personnel carrier.

The man who designed and built the stand, SFC James W. Morgan, says that now he has it in operation he can put a guarantee on every rebuilt transmission his shop sends out. Complaints and returns have been practically eliminated, he said.

Captain T. G. Smith, commander of Headquarter & Headquarters Company, says Sergeant Morgan's test stand "takes the guesswork out of rebuilding transmissions."

The captain adds: "If this was a commercial garage, we could stick a 'guaranteed' label on every job we did . . . thanks to Sergeant Morgan."

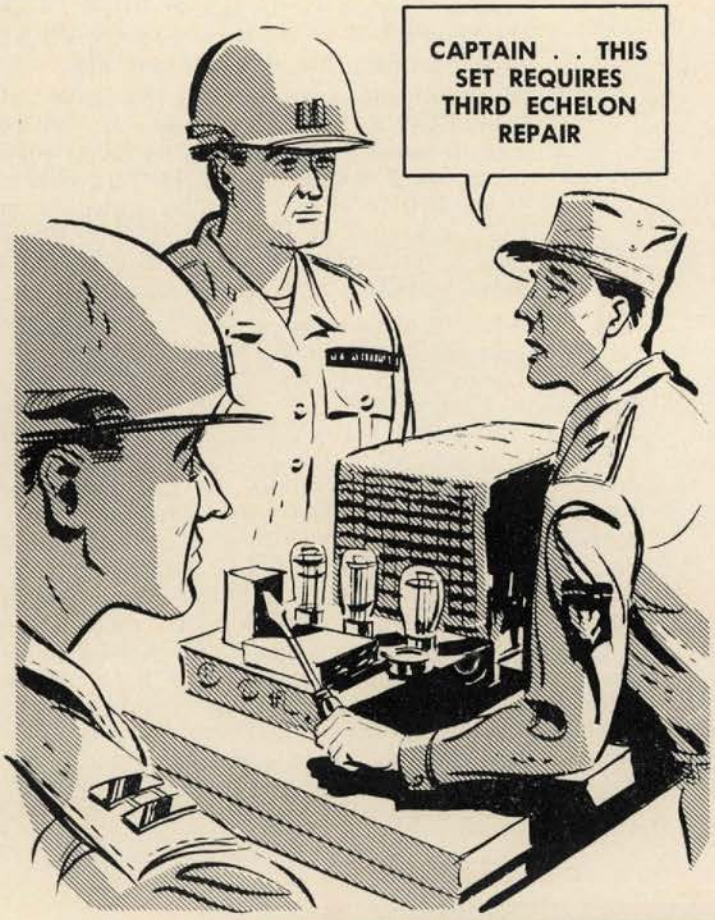
Self-Propelled Mortar

A recently developed Ordnance combat vehicle is the full-tracked, self-propelled amphibious 81mm mortar, T257. The new vehicle weighs 18,760 pounds and may be dropped from aircraft *via* parachute. It is 84-⅝ inches high and has a ground clearance of 15 inches. It carries a commander, driver and 4-man mortar crew at 40 miles an hour on land and 4 m.p.h. in water.

The tanklike hull of the T257 is built of lightweight metals and is similar to the T113 armored personnel carrier. It has 12-inch-wide tracks, torsion-bar suspension, and is powered by an air-cooled 208-horsepower Continental 4-cylinder opposed engine through an Allison XGT-90-1 transmission. It was developed under contract with Food Machinery and Chemical Corporation.

how would you do it?

US ARMY ARMOR SCHOOL PRESENTATION



SITUATION

You are the communication officer of the 1st Medium Tank Battalion (Patton), 1st Armor, 301st Armored Division. Your battalion, which is operating as a task force in a corps field training exercise, has requested artillery fire support, which must be fired as a multiple fire mission using fire direction net No. 2 for adjustments.

The artillery liaison officer from the direct support artillery battalion has informed you that one of the Receiver-Transmitters RT-67 of his Radio Set AN/VRQ-2 is inoperative. You have the senior radio mechanic inspect the set, and he tells you that some of the wiring in the RT-67 is burned and that the trouble is beyond his echelon of repair. No spare RT-67's are available, and an RT-66 cannot be used in this net.

FIRST REQUIREMENT

1 What vehicles and radio equipment does an artillery liaison officer bring with him from his own unit when operating with an armor battalion task force?

2 What vehicle and radio set does the task force headquarters provide the artillery liaison officer?

3 How is each of the radio sets available to the artillery officer normally employed?

Referring to the division SOI, you note that the frequency of the artillery battalion command net FM is 29.5 mc and that the frequency of the artillery battalion fire direction net FM No. 2 is 32.0 mc.

SECOND REQUIREMENT

1 Knowing that the liaison officer has one defective RT-67, how would you advise him to employ his remaining communication equipment so that he can operate in his required radio nets at a range of 6-8 miles?

2 How would he use the tank radio in conjunction with his own equipment so that he can have automatic retransmission back to his own unit?

TURN PAGE FOR SOLUTIONS

PREPARED BY: COMMUNICATION DEPT USAARMS **ILLUSTRATION: MR J H BAIN**

FIRST REQUIREMENT

1 The artillery liaison officer brings from his own unit a ¼-ton truck and an armored personnel carrier, which mounts Radio Sets AN/VRQ-2 and AN/VRC-8. In addition, he brings a Radio Set AN/PRC-9 for dismounted operation.

2 The task force headquarters furnishes the liaison officer with a tank mounting a Radio Set AN/GRC-3.

3 This radio equipment normally operates in the following nets:

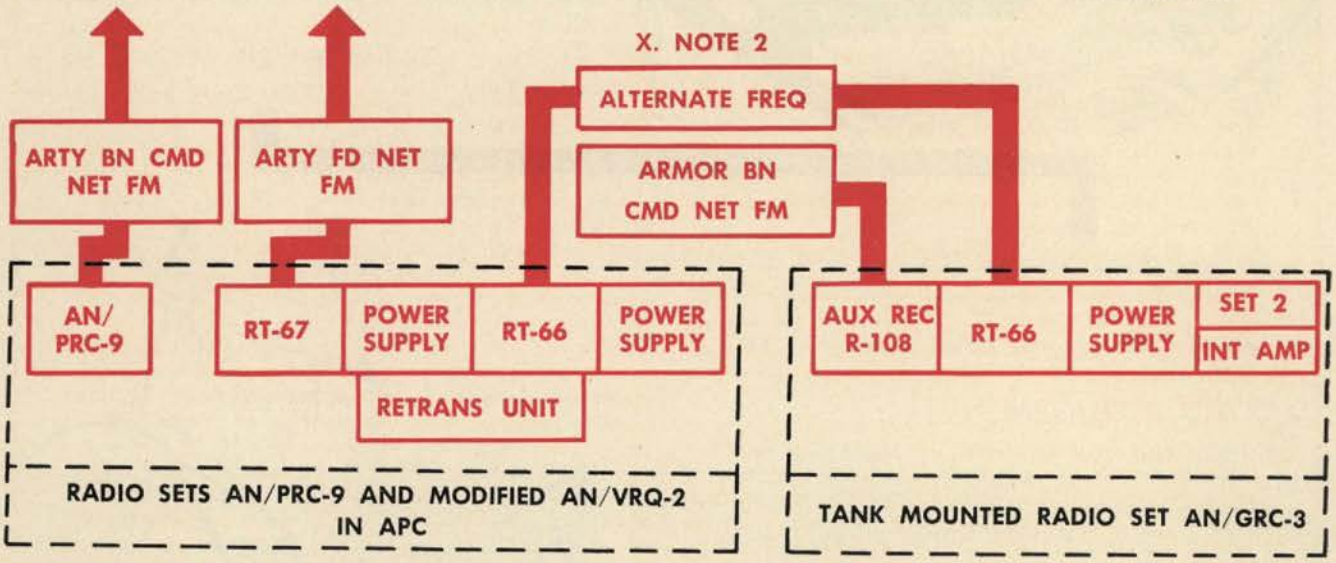
a. Half of Radio Set AN/VRQ-2 in the artillery battalion command net FM.
b. Half of Radio Set AN/VRQ-2 in the artillery fire direction net FM.
c. Radio Set AN/VRC-8 in the armor battalion command net FM.
d. Radio Set AN/PRC-9 in the artillery fire direction net FM. (When the liaison officer is dismounted.)
e. Radio Set AN/GRC-3 in the armor battalion command net FM.

SECOND REQUIREMENT

1 So that the artillery liaison officer can maintain communication in all of his radio nets at extended ranges, you advise him to employ his remaining radios as follows:

a. Since artillery fire direction is his primary mission, you advise the liaison officer to use the good RT-67 of his Radio Set AN/VRQ-2 in the artillery fire direction net FM.
b. Since only the transmitter of the Radio Set AN/PRC-9 is limited in range, you advise him to monitor the artillery battalion command net FM with the AN/PRC-9 receiver. If a call is received, it can be answered on the transmitter of the good RT-67. When used in this manner, the AN/PRC-9 is acting as an auxiliary receiver for the RT-67.

2 So that the liaison officer can have automatic retransmission facilities from the tank back to his unit, you advise him to remove the defective RT-67 from the mount of the AN/VRQ-2 and replace it with the RT-66 of the Radio Set AN/VRC-8 in his armored personnel carrier. With the AN/GRC-3 and RT-66 of the modified AN/VRQ-2 on the same alternate frequency, which is assigned to the armor battalion, transmissions from the AN/GRC-3 in the tank could be received on the RT-66 and then automatically retransmitted on the RT-67, using the retransmission unit in the modified AN/VRQ-2. To do this, an operator would be required at the AN/VRQ-2 to set up retransmission facilities. When the Set 1 of the AN/GRC-3 in the tank is being used for retransmission, the liaison officer, using the auxiliary receiver, monitors the armor battalion command net.



NOTE 1. When retransmission is used to the artillery fire direction center, a retransmission frequency will be used.

NOTE 2. When not used for retransmission purposes the RT-66's are used in the armor Bn Cmd Net FM.

DISCUSSION

As a communication officer you will encounter many problems of this kind. In many cases, as in the problem presented, they will require an immediate solution. If replacement equipment is not available, it may be necessary to use an expedient. In order to cope successfully with this type of problem you must have a thorough knowledge of the capabilities and limitations of all of your communication equipment and the communication requirements of every individual in your organization.

FROM THESE PAGES

65 Years Ago

If opposed to mounted cavalry, the cavalry on the defensive should endeavor to subject it to an annihilating magazine fire at short range, a reserve being kept mounted. If the assailants are thrown into confusion by the fire, or if they attempt to dismount, an opportunity may be offered to the reserve to charge them, or to attack their led horses.

As a rule, cavalry should avoid engaging in a dismounted fight with infantry; but should an emergency demand such action, it should endeavor to make up for its inferior shooting power by its superior mobility. Cavalry may often, by celerity of movement and skill in utilizing concealing features of the terrain, be able to strike the flank of a marching column of infantry, which it can annoy and throw into disorder with its fire, gradually withdrawing from the firing line as the infantry becomes engaged, and mounting and retreating before it can receive heavy loss in return.

Dismounted fire action adds immeasurably to the independence and fighting power of cavalry, and is an indispensable part of the functions of that arm; but, great as its importance is, it is only the complement of mounted action, and must never be regarded as the chief use of cavalry.

CAPTAIN ARTHUR L. WAGNER

Cavalry in Attack and Defense

25 Years Ago

The cars are invaluable for securing information of the enemy at a distance; seizing and holding until the horse elements arrive; defense against aviation, especially enroute; the rapid transference of firepower to critical points; withdrawals; delaying actions; pursuits; and in practically all reconnaissance, counter-reconnaissance and security missions.

The cars provide two distinct means of engaging an enemy, either simultaneously or alternately, and provide the commander with a highly mobile fire reserve.

Motors tend to use up enemy cavalry. "In the German invasion of Belgium the armored car early proved its value for patrol work. It exercised another important influence on the cavalry arm, in that it placed correspondingly a greater strain on the mobility of cavalry and, to that extent, used up the horses of the enemy at an additional rate."

The cars were valuable for scouting and patrolling when the main command was enroute and when the road net was known. In scouting expeditions by troop or squadron from the main camp, the cars remained in camp, when the nature of the terrain was unknown.

The motor machine gun unit of a horse cavalry regiment should be of a size, with adequate power, personnel and armament for temporary independent action.

COLONEL ALBERT E. PHILLIPS

The First Motorized Cavalry

50 Years Ago

Some military writers improperly use the term "cavalry" to mean troops who fight habitually mounted, and "mounted infantry" for troops who fight both mounted and dismounted. A more correct application of the term "cavalry" is to apply it to the latter named force, exemplified in our American trooper, and the term "mounted infantry" for foot troops who use the horse only as a means of transport. Early's mounted forces in the Valley claim that their defeat was chiefly due to the fact that Sheridan's cavalry, unlike themselves, were armed and trained for mounted as well as dismounted action.

It was the absence of Confederate cavalry and the presence of Union cavalry under Buford which made it possible for Reynold's infantry to seize and occupy that magnificent defensive position which insured victory to the Union arms at Gettysburg, and it was such cavalry which, under Sheridan, culminated that victory at Appomattox.

Cavalry, to be effective in its many capacities, must in addition to its mounted training, be the equal in all respects when dismounted to infantry, man for man and arm for arm. Our American soldier is fully capable of such qualification, but he cannot be improvised, and to so qualify him the fighting units (troop and squadron) of which he is a part must be maintained in peace on the same status they will be used in war, with a *reserve* of *men* and *remounts* provided for war contingencies.

CAPTAIN ROBERT E. L. MICHIE

Cavalry Reorganization

10 Years Ago

Intimate association must exist between tanks, armored infantry, armored engineers and armored artillery if cooperation—the combined arms teamwork—is to be achieved. This cooperation must be based upon an understanding of the employment and capabilities of each by the other.

It must be fully realized that an armored field artillery battalion is a fighting unit. Here lies its principal difference from the artillery of the infantry division and other towed artillery. You will find no outstanding differences from other artillery in a search of Tables of Organization, training procedures or written doctrine on its employment. Rather it might be said that armored artillery is a "state of mind." Its aggressive spirit for forward movement and contact with the enemy makes it an almost different arm, for it must exhibit the same characteristics of firepower, mobility and shock action expected of other members of the combined arms team. Its commanders must be progressive and ingenious. No rigid set of operating procedures are applicable to its functioning, for it must be able to deliver fire with the utmost speed under all conditions and situations, and be able to defend itself from hostile attack while in firing position or on the march. It may be called upon to accompany tanks without supporting infantry. These capabilities are not the result of special equipment alone but must be the result of aggressive thought and action on the part of its commanders.

MAJOR RALPH A. CLICK

Armored Artillery in the Team

THE BOOK SECTION

THE TANKS: 1914-1945

THE TANKS: 1914-1945. By Captain B. H. Liddell Hart, 2 vols.; 1017 pp. Frederick A. Praeger, Inc. $15.00 (Set).

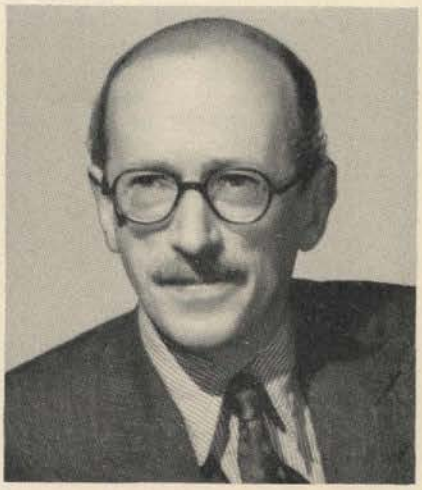
Reviewed by
Colonel Robert J. Icks, USAR, Ret.

THIS is the long awaited history of the Royal Tank Regiment and its predecessor organizations. It was in preparation for 12 years, ever since the author was asked in 1946 by the Historical Committee of the Regiment to undertake it. Liddell Hart was a happy choice. Not only has he been for many years a gifted exponent of the use of armor and closely associated with matters of policy but his stature in the larger field of warfare in general is unquestioned.

It must have been a monumental task. The research represented is of very considerable proportions. In addition, since this was a commissioned work, the author must have faced the problems of satisfying an official committee and reconciling official viewpoints. Liddell Hart did not do the entire job. It is not known why unless it was because of conflict with official pressures or because the Committee was anxious for publication. At any rate, certain portions are rounded out by pieces done by others. Lieutenant General Sir Harold Pyman, Major General N. W. Duncan, Major E. W. Sheppard, Major John Masters assisted by others, cover special areas. These have been blended in skilfully and the book loses little because of it. However, the areas are very sketchily covered for anyone interested in some of the minor combat areas and the story behind the story of some of the history of the Royal Tank Regiment.

Although this is a British book about Britons, it is an important one to Americans as well. Historically there have been many parallel situations. Being allies, there are many points where our experiences were joint or related. Most important, British developments between the two World Wars in the area of armored mobility were eagerly studied in other countries including our own and were of considerable influence, to some ex-

THE AUTHOR



B. H. Liddell Hart has long been recognized as one of the world's outstanding military analysts. He served with the British Army during World War I and retired in 1927 to devote his full time to his writing career. He has been Military Correspondent for several of England's leading newspapers, and also the Military Editor of the Encyclopaedia Britannica. He was the originator of many new ideas and methods which were adopted by the British as well as many other armies. He is considered one of the pioneers in mechanized warfare concepts. His writings have probably been read and studied by more military persons throughout the world than any other modern-day writer. Among the many books he has written of a military nature the following are just a few: *The German Generals Talk, The Revolution in Warfare, Defence of the West, The Strategy of Indirect Approach, The Remaking of Modern Armies,* and recently, Editor of *The Red Army.*

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

Benjamin Franklin

Although this is a British book about Britons, it is an important one to Americans as well. Historically there have been many parallel situations. Being allies, there are points where our experiences were joint or related.

tent more than in native England.

Volume One begins with an excellent exposition of armor from antiquity to World War I. The story of the concept of Armor by Royal Naval Air Service personnel, General Swinton and others in World War I; the initial sponsorship which has left us a legacy of naval terms like turret, sponson, bow and hull; World War I indecision and piecemeal use, all have been told by others but never better. The fundamental use of Armor in mass was learned the hard way and led to Fuller's "Plan 1919" which was the real tactical lesson of World War I. Yet England and the other victors officially retained only the actual experience of the war as it was fought. Plan 1919 had only been a plan never actually carried out or the events between the two World Wars might have taken a completely different direction.

For several years there was confusion in England as to whether the Tank Corps would even be retained and whether Armor was to be under the Royal Engineers or the Royal Air Force. The latter actually did take over responsibility for armored cars in the Near East, an act which crystallized decision and led to the creation of the Royal Tank Corps. Even after this decision, there was an attitude of approaching Armor with a preconceived idea as to how it should fit in with other arms rather than how best it could be used. The extreme tank enthusiasts as well as those who considered Armor obsolete both obstructed the working out of sound joint tactics because there was no compromise on either side.

In spite of this, the development of faster and more reliable vehicles led to creative tactical thought and an experimental armored force which attracted widespread attention. High speed vehicles, tank radios, tank intercoms, tank combat drill, tank gunnery all were conceived and developed. Dwight Davis, then our Secretary of War, saw this force in the summer of 1927. On his return to this country, he ordered General Summerall, then Chief of Staff, to establish a similar organization "not as a part of the Infantry or Cavalry but as a new arm." Even before that, we had followed

THE REVIEWER

Colonel Robert J. Icks, USAR, Retired, has been an armor enthusiast since the twenties. He is the author of several books and numerous articles on the subject, the most recent of which will appear in the forthcoming revision of the Encyclopaedia Britannica. His book and photographic library is one of the most complete in the world, covering the past sixty years of armor development. By advance agreement with the Library of Congress, it will be willed to them. Colonel Icks was closely identified with armor design and production during World War II at the Aberdeen Proving Ground and at the Office, Chief of Ordnance, Detroit and was awarded the Legion of Merit and the Army Commendation Ribbon. He is a member of the Ordnance-Industry Light Tank Committee. Presently he is a management consultant in the Insurance Department of the internationally known public accounting firm of Peat, Marwich, Mitchell & Company.

British developments with more than interest. As early as 1922, our experimental medium tank of that year was almost a "Chinese copy" of Colonel Philip Johnson's post-war Medium D tank and we also explored to some extent the possibilities in an all-purpose vehicle chassis, following a British lead.

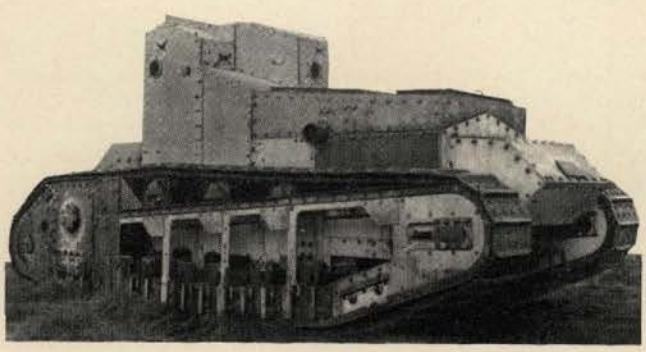
Although our first mechanized force was short-lived for lack of funds, a small sum was included in the 1931 FY budget for its reestablishment through the efforts of General Adna R. Chaffee, then a major on the General Staff. General Summerall's last official act before retiring was to order the assembly of such a force but his successor, General MacArthur, assigned responsibility to the Cavalry and brought on a period distinguished by inadequate funds and inter-service bickering and jealousy. That is another story, however, but it paralleled much of what happened in England. Service politics, the compromises in preserving conventional cavalry and attempts to keep tanks subservient to infantry, short appropriations, changes in political parties, disarmament conference influences and the world-wide Depression affected both countries.

In spite of all this, a relatively small group of dedicated men in both countries kept the goals of controlled mobility and striking power before them. The cost was higher in England than it was here, however. Five British proponents of armored warfare, including J. F. C. Fuller and G. Le Q. Martel, reached the rank of major general between 1930 and 1937 and each was retired or given no assignment. Liddell Hart's own part in the affairs of the period is given modestly and objectively.

Volume Two covers the period of World War II, beginning with the German blitzkrieg in Poland and France and then shifting to North Africa. Here, in spite of the gradual acceptance of the basic principles of proper use of Armor, British practice was still that of conventional generalship. It is one of the paradoxes of history that the Germans in France and North Africa were outnumbered in both troops and Armor yet used them to far better tactical advantage. The dedicated creative thinking of the period between the wars failed to withstand the dilution of wartime expansion.

These actions as well as most of the other actions in Volume Two are accurate and impartial. This volume goes on to describe the campaigns in Sicily and Italy, the Normandy landing and British operations in Europe to the end of the war. It is understandable that the British are as proud of their armored drive of 230 miles in seven days to take Antwerp or their thrust from the Rhine to the Baltic as we are of the swing around Paris and our other armored operations. It is only natural that there is relatively little connecting tissue of American and other Allied operations. This is a British history. Yet there might have been more balance had a little broader and firmer connecting tissue been added. Americans may be startled to read, for example, that the German attack at Kasserine "was finally repulsed by the British 6th Armoured Division which had been rushed down from the north."

There are a few other shortcomings. Less detail on the maneuvers of the experimental armored forces in the 30's would have been desirable. The period from 1937 to 1939 is glossed over rather hurriedly. The entire "home front" situation between 1939 and 1945 is dismissed in fewer than nine pages by one of the authors other than Liddell Hart. The influence of the Spanish Civil War is ignored. No mention is made of D'Eyncourt, Swinton, Ricardo, Stern and others who, as "The Old Gang" volunteered to form a Tank Committee at the Ministry of Supply in 1939 and the quarrels with Churchill which broke it up. The Far East campaigns are touched on only lightly, probably because most of the Armor was Indian. The Select Committee on National Expenditures whose reports were so critical of British tank production and use is mentioned only briefly. No mention is made of the Vote of Censure and the far-reaching shakeups which resulted from the press dispatches from North Africa on June 12, 1942 and following the fall of Tobruk. Neither is there anything about the impact on the Royal Tank Regiment of problems of supply and maintenance and the struggles for power between Ordnance, the Royal Army Service Corps and R.E.M.E. (Royal Electrical Mechanical Engineers). British tanks were poorly



Experimental Medium Mark A

Vickers Experimental Wheel and Track Tank

Independent tank

Cruiser tanks Mark IIa

maintained until R.E.M.E. influence began to make itself felt in 1943. Poor British maintenance was no small element in German success in the desert until 1943. Although these may not have been directly a part of the history of the Royal Tank Regiment, they helped to shape its fortunes.

The dust cover flap includes the statement "This history chronicles in forthright detail the battles of peacetime and wartime, the strivings of the wise men and the short-sighted, of visionaries and reactionaries." By the omission of some of the facets mentioned, this is only partially true. But this is good history and well written. Until some of the persons and personages involved pass from the scene or until a history free from official pressures can be written, these volumes will be definitive and well worth owning by any student of Armor or of warfare.

The maps and most of the illustrations are good. One wishes that the artists' concepts of tanks in action in World War I and the frontispiece of King George V in a Tank Corps beret had been omitted in favor of such historical landmarks as the Rolls Royce armored cars, the Medium D tank series, the Carden Loyds and more of the specialized Armor of World War II. Yet it must be said that a fair number of interesting historical British vehicles are pictured including the Independent tank of 1926. This last was the vehicle which figured in the famous Baillie Stewart spy case and which influenced the designs of the modern day Soviet Stalin III and T54 tanks.

Liddell Hart, in a short final chapter, concludes that speed and mobility have gained in importance with the advent of nuclear warfare and that armored forces must "free themselves of impedimenta" and be capable of self-sustained operation.

The appendices cover battle honors and individual awards, regimental distinctions and traditions, organizational changes and comparative data tables of British, American, German and Italian tanks. The Index in each volume is outstanding. The Foreword by Field Marshal Viscount Montgomery of Alamein is a tribute to those who supported the concept of mobility in spite of opposition and to those who carried out that concept in battle.

Photographs submitted, courtesy of the Reviewer

Churchill V Pilot with 95mm Howitzer

Centurion II

FORGE of LIBERTY:

The Dramatic Opening of the American Revolution

By LEONARD FALKNER

A stirring re-creation of the events leading up to the Revolutionary War, notably the battle of Lexington and Concord where King George's trained forces were defeated by a small band of minutemen. The author, feature editor of *The New York World-Telegram,* has used actual letters, diaries and documents for his source material.

$4.50

The Nine Days of Dunkirk

By DAVID DIVINE

The amazing and almost incredibly gallant rescue of some 250,000 soldiers from the beaches of Dunkirk—by 848 ships, boats, yachts, fishing smacks, and by men, women and youngsters—was only matched by the ingenuity and courage that brought those soldiers to the beaches in spite of the terrific odds.

$3.95

PLEASE KEEP US INFORMED OF YOUR CORRECT ADDRESS

ORDER FORM BOOKS BINDERS - *Armor*
1757 K Street, N.W., Washington 6, D. C.

Please send me the following:

_____

_____

_____

_____

_____

_____

NAME (Please Print)

ADDRESS (Street or Box Number)

CITY (Town or APO)

STATE

☐ I enclose $.....
☐ Bill me. (Members only.)
☐ Bill unit fund.

Up Came Hill

The Story of the Light Division and its Leaders

By MARTIN SCHENCK

$5.75

A. P. Hill and his officers and men saw more front-line action than most of Lee's army. But their dreadful losses and other vicissitudes of campaigning left a searing imprint on the former U. S. Army captain whose normally friendly spirit had to be submerged by the stern requirements of combat leadership. In less than three years he rose to the rank of corps commander and at the end was Lee's closest adviser.

The story of the incomparable fighting men in the ranks is told, too. Hill's Light Division bore the brunt on the Peninsula when Jackson faltered, saved the day at Slaughter's Mountain, withstood formidable assaults on the army's flank at Second Manassas, saved the day at Antietam. It distinguished itself in every major battle from Mechanicsville to Five Forks.

Featured also is the bitter animosity which flared between Hill and Jackson, with a discussion of Jackson's more evident peculiarities and failures in campaign. These passages may cause lifted eyebrows in some quarters but will win nods of agreement from readers who have long felt that the legendary Stonewall was not altogether without flaw.

It constitutes, too, an admirable and overdue tribute to an outstanding leader and to one of the grandest fighting units in which Americans have served. A must for Civil War enthusiasts.

Cleburne And His Command

By CAPTAIN IRVING A. BUCK, C.S.A.

$6.00

This is the simple and plain narrative of Patrick Cleburne and his command, written by his Adjutant Captain, Irving A. Buck. It ranks among the best of Confederate memoirs.

For nearly two years, Buck served as an active member of Cleburne's staff in the Army of Tennessee. His account is a modest one, and what he didn't actually experience, he wrote only after verification of facts.

In battle, Cleburne seems to have had a charmed life. At Richmond, he was shot through the mouth. At Perryville, he was wounded by a cannon shot that killed his horse. He passed unscathed through the fierce conflicts at Murfreesboro, Chickamauga, Missionary Ridge, Ringgold Gap and the battles of the Atlanta Campaign. Finally, at Franklin, while charging with his men on foot, he met his death.

"When Cleburne's division defended, no odds broke its lines; where it attacked, no numbers resisted its onslaught, save only once, and there is the grave of Cleburne."—Gen. W. J. Hardee

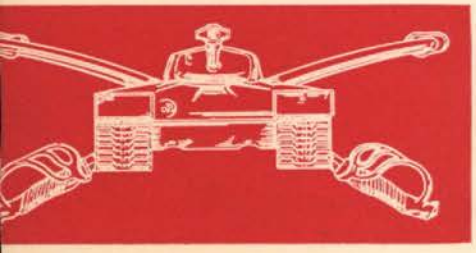
Arms Of Valor

By LT. GENERAL PAVLO SHANDRUK

$6.00

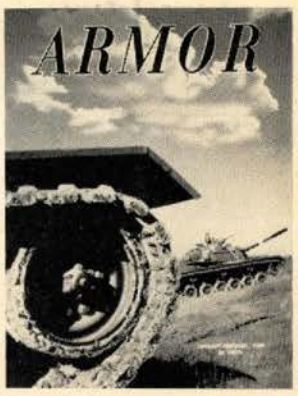
The memories of the Commander-in-Chief of the Ukrainian National Army and President of the Ukrainian National Committee reveal his dedication to the fight to liberate the Ukraine and the subjugated nations in the Russian Empire. He attributes the defeat of the Ukrainian nation to the refusal of aid from other nations of the free world. These memoirs are the expression of the distinction and valor of the Ukrainian Army in their fight for freedom. One of the most stirring stories of our century.

WHO: The United States Armor Association is the continuation of the United States Cavalry Association, first of the ground arms associations, established in 1885. It is a society of professionals banded together to disseminate knowledge of the military art and sciences, with special attention to mobility in ground warfare; to promote the professional improvement of its members; and to preserve and foster the spirit, the traditions and the solidarity of Armor in the Army of the United States.



WHY: The answer to WHY an Association, of course, is that unity of purpose and action of a professional group will carry them farther than any amount of individual effort. The Armor Association, composed of professionals experienced in the mounted, mobile and self-propelled fields, produces a more intelligent dissemination of knowledge of mobility in ground warfare; and brings us closer to our common goal—that of keeping American Armor and its personnel tops in the world. This we intend to do.

HOW: This is accomplished in two ways: first, through the Association's periodicals, ARMOR and the NEWSLETTER. Here thoughts on mobile warfare are spotlighted; tactics, training, equipment, logistics, etc., are presented by qualified authors; and secondly, it gains impetus at the Annual Meeting of the membership. Here the Association's business is discussed, demonstrations of Armor are presented, and papers on mobility in ground warfare are presented by outstanding professional personnel.



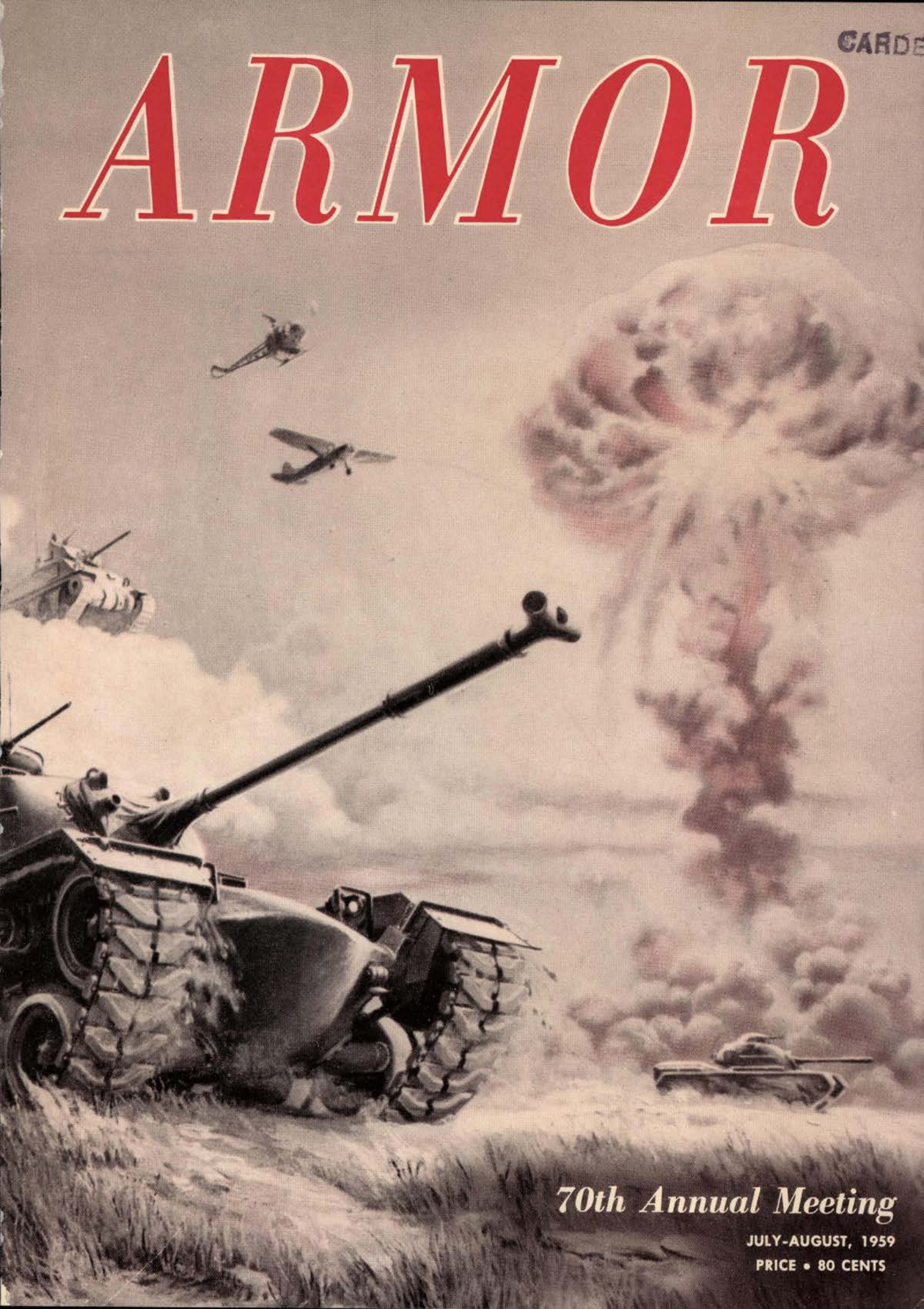
Established 1885

The United States Armor Association

Publishers of ARMOR
1757 K Street, N.W.
Washington 6, D. C.

CARDE

ARMOR



70th Annual Meeting

JULY-AUGUST, 1959

PRICE • 80 CENTS

The Failure of Atomic Strategy

By F. O. MIKSCHE **$4.50**

Under what circumstances is atomic warfare likely to break out? Is it possible for the Western world to defend itself against a future atomic attack? Is it sound policy on the part of the West to rely on atomic weapons for its defense? In this book, Colonel F. O. Miksche, one of the world's foremost military theorists, answers these and dozens of other vitally important questions regarding the failure of the Western world's present policy of atomic strategy.

It is Colonel Miksche's contention that the West has been out-maneuvered in practically every aspect of atomic strategy and that, as a result, we are today living in a state of "atomic paralysis" a paralysis which, he believes, is grotesque and completely unrealistic in the light of our manpower reserves, our wealth of raw materials, and our highly efficient systems of production. He therefore presents in this book a concrete plan by which the West could seize the initiative in the present atomic stalemate and could put into operation a plan which is based on realistic strategy. In this way, he believes, the world could well be saved from disaster.

The author has included a wealth of fascinating insights into atomic warfare as well as into atomic strategy. He has visualized for the reader the nature of atomic battlefields of the future. He has weighed the possibilities of air defense in nuclear warfare. He has demonstrated how armies of the atomic era can be made more efficient. The reader may not agree with Colonel Miksche's conclusions, but he cannot fail to be impressed by the vigor and the vision of this book.

KŌGUN: The Japanese Army in the Pacific War

By SABURO HAYASHI **$4.50**

in collaboration with ALVIN D. COOX

Volumes have been written about the U. S. Forces and the Pacific War, but to date little has been published concerning the Japanese side from the standpoint of high-level command plans and policies. KOGUN fills the gap of this long-felt need.

It commences with a sound analysis of the Meiji era background and moves on with authority to treat significant trends and causes (as well as results) of the tragedy which was prewar Japanese militarism.

The author presents his thesis simply and focuses his discussion on the following problems: How did the army high command estimate the situation throughout the Pacific War? On what thinking were its plans of operation founded? How did it actually conduct matters?

From this framework a remarkably clear picture develops of high command errors in making estimates of the situation; mismanagement in the conduct of operations and internal disagreement on basic policy.

Guide for Army National Guardsmen

By COLONEL JAMES B. DEERIN **$3.50**

Here for the first time is a training and reference manual prepared especially for National Guardsmen by a qualified National Guard officer. This text is a reference book that will be a value to everyone from recruit to commander. It will provide you with the information you need to do your job more efficiently and furnish you with background information and a digest of all major regulations which govern training and administration.

This book not only explains but illustrates the mechanics of organization, training, supply, administration, etc. This is a book for the ambitious Guardsman who wants to be well informed and get ahead in the Guard.

The United States Armor Association

(Established 1885)

President
LT. GEN. GEORGE W. READ, JR.
Honorary President
MAJ. GEN. GUY V. HENRY, RET.
Vice Presidents
MAJ. GEN. W. PAUL JOHNSON
MAJ. GEN. DONALD W. MCGOWAN, NG
COL. WILLARD WEBB, USAR

Honorary Vice Presidents
GEN. JACOB L. DEVERS, RET.
GEN. WILLISTON B. PALMER
GEN. WILLARD G. WYMAN, RET.
LT. GEN. EDWARD H. BROOKS, RET.
LT. GEN. CLOVIS E. BYERS, RET.
LT. GEN. JOHN H. COLLIER, RET.
LT. GEN. WILLIS D. CRITTENBERGER, RET.
LT. GEN. HOBART R. GAY, RET.
LT. GEN. ALVAN C. GILLEM, JR., RET.
LT. GEN. GEOFFREY KEYES, RET.
MAJ. GEN. ERNEST N. HARMON, RET.
MAJ. GEN. JOHN C. MACDONALD, RET.
BRIG. GEN. SIDNEY R. HINDS, RET.
BRIG. GEN. WILLARD A. HOLBROOK, RET.
BRIG. GEN. HENRY CABOT LODGE, USAR
BRIG. GEN. PAUL M. ROBINETT, RET.
BRIG. GEN. HARRY H. SEMMES, RET.

Secretary-Treasurer
LT. COL. WILLIAM H. ZIERDT, JR.

Executive Council
GENERAL BRUCE C. CLARKE
LT. GEN. THOMAS L. HARROLD
LT. GEN. ARTHUR TRUDEAU
MAJ. GEN. FREDERIC W. BROWN
MAJ. GEN. HOMER O. EATON, NG
MAJ. GEN. ROBERT E. FRANKLAND, NG
MAJ. GEN. LOUIS V. HIGHTOWER
MAJ. GEN. CLAYTON P. KERR, NG
MAJ. GEN. HARRY W. JOHNSON
MAJ. GEN. SAMUEL L. MYERS
MAJ. GEN. ALMERIN C. O'HARA, NG
MAJ. GEN. JAMES B. QUILL
MAJ. GEN. MAXWELL C. SNYDER, NG
MAJ. GEN. JOHN K. WATERS
MAJ. GEN. EARLE G. WHEELER
MAJ. GEN. EDWARD O. WOLF, NG
BRIG. GEN. CHARLES G. DODGE
BRIG. GEN. JAMES I. KING
BRIG. GEN. HAL C. PATTISON
BRIG. GEN. FRANK HENRY
BRIG. GEN. W. H. S. WRIGHT
COL. BOYD BRANSON
COL. LAWRENCE V. GREENE
COL. DELK ODEN

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR
Lt. Col. William H. Zierdt, Jr.

BUSINESS MANAGER
M Sgt J. William Joseph

ASSISTANT TO THE EDITOR
Sfc Michael E. Kekker

CIRCULATION MANAGER
M Sgt William Coley, Jr.

Volume LXVIII JULY-AUGUST, 1959 No. 4

CONTENTS

LETTERS TO THE EDITOR 2

THE SEVENTIETH ANNUAL MEETING OF THE UNITED STATES ARMOR ASSOCIATION 4
- Report on the Annual Meeting by the Secretary 6
- Message from the President of the United States 9
- The Keynote Address 10
- Strategic Aspects of Firepower, Mobility and Shock Action—Today and Tomorrow 15
- Some Thoughts on Armor of the Future 19
- Armor Mobility—A Challenge to Industry 25
- Army Missiles and Space Technology 28
- The New Council 31
- Salutes From Around the World 32

OBJECTIVES FOR ARMOR OF THE FUTURE 34
By General Bruce C. Clarke

TANK COMMANDER TRAINING IN THE RESERVE COMPONENTS 37
By Dr. Robert A. Baker

THE CHIEF OF STAFF, UNITED STATES ARMY 40

VICTORY BEFORE DAWN 42
By Marvin Parrott

EDITORIAL 46

RECONNAISSANCE PLATOON LEADER 48
By Colonel William E. Potts

U. S. ARMOR ASSOCIATION AWARD 49

2D ARMORED DIVISION TANKS AT BATTLE OF ALAMEIN 50
By Lieutenant General Willis D. Crittenberger, Ret.

UNITED STATES MILITARY ACADEMY CLASS OF 1959 ARMOR GRADUATES .. 52

OUTSTANDING SENIOR 1959 ROTC ARMOR CADETS 53

NEWS NOTES 54

FROM THESE PAGES 56

HOW WOULD YOU DO IT? 57
A U. S. Army Armor School Presentation

THE BOOK SECTION 60

SWAMP FOX: The Life and Campaigns of General Francis Marion 60
Reviewed by Jac Weller

A GUIDE TO ANTI-COMMUNIST ACTION 62
Reviewed by Colonel James N. Peale, Jr.

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and editorial offices: 1757 K Street, N.W., Washington 6, D. C. Copyright 1959, by the United States Armor Association. Second-class postage paid at Washington, D. C. and at Additional Entry. Terms: Domestic subscriptions, including APO's, $4.75—one year and $8.00—two years. Foreign, including Canada & Pan America, $5.50—one year and $10.00—two years.

LETTERS TO THE EDITOR

New Items of British Equipment

Dear Sir:

After reading about the M60 in the March-April issue of *ARMOR*, your readers may be interested to hear of new developments on this side of the Atlantic.

It was revealed during the defense debates in Parliament that our new medium gun tank is now doing its trials. It mounts a high velocity 105mm gun and *may* be air transportable. This last statement is a bit obscure, but our largest air force load-carrier will be the Bristol Brittanic carrying about 35 English tons (39 American) over 1,200 miles at speed. Previously it was thought that our new tank would be about 40 to 45 tons, as opposed to the new French-German-Italian proposals for a 30 ton vehicle.

A clue to how this reduction in weight may have been achieved lies in the persistent rumors that one new feature is a prone or supine driver's position. It is known that one prototype with this feature has already been tested, weighing about 20 percent less than the Centurion, and having a much lower silhouette.

As an interim measure the 49 ton Centurion is being re-armed with the 105mm, and its armor protection increased, from the present maximum of 6″ given by "Taschenbuch der Panzer."

The long range antitank guided missile is to be mounted in an air-transportable light armored vehicle and operated by the Royal Armored Corps, replacing the Conqueror 120mm gun tank.

Artillery support for the armored brigades will be provided by a new self-propelled 5.5″ gun howitzer utilizing the Centurion chassis. This gun fires an equivalent shell to the U. S. 155mm howitzer, to a longer range, a good point for atomic-dispersion tactics.

A new Armored Personnel Carrier has been developed, and also a tracked armored load-carrier. Reconnaissance units will have the Saladin and Feret heavy and light armored cars, and the Saracen A.P.C. All these are cross-country wheeled vehicles, combining high road speed and silent running.

The standard infantry antitank weapon at present is the Mobat 120mm jeep-towed recoilless gun, aimed by "hose-piping" with a Bren light machine gun on the same mounting.

A new weapon, which will probably replace the Mobat is the Wickens Vigilant, wire-guided missile, which, with carrying-case launcher, and control set, is a lighter load than a 60mm mortar or a Browning .30 caliber machine gun.

Having given this information I would like to ask for some. What do we know about the performance of the Russian 100mm gun in comparison with our own weapons? Have they equivalent ammunition to your Hypershot and our Sabot? If they have, does inaccuracy limit its use to short ranges, as with the earliest types of Sabot?

PHILIP BARKER

99 Brentford Road
King's Heath
Birmingham 16, England

Re: Armor Command

Dear Sir:

The review of *Armor Command* in the March-April issue of *ARMOR* contains four major points which should not be allowed to pass without comment:

First, the remarks about the alleged attitude of the Ordnance Corps toward the tanks designed by J. Walter Christie are grossly misleading: Ordnance had supported Christie and seven tanks were purchased from Christie in 1931, *i.e.*, at the same time as the Russians bought their two Christie models. However, as Christie failed to fulfill the terms of the contract, the next order for Christie-type tanks for the U. S. Army, the T3E2 mediums, went to the American La France and Foamite Company; next, Ordnance designed and built the T4 medium, which was a considerable improvement on Christie's own design, and it was only after several tanks of this type had been completed that, in 1936, the development of Christie-type vehicles was abandoned.

Secondly, the comments made on the M3 medium are unfair for they ignore completely the circumstances in which this tank was designed: it was an emergency design rushed through in 1940 in order quickly to obtain a 75mm gun tank to replace the contemporary M2 medium which had nothing heavier than a 37mm gun. As such, the M3 was successful and although it was far from ideal it proved itself in mid-1942, in the hands of the British troops in Libya, when it was the only well-armed tank available to the Western Allies.

Third, the comparison between gasoline-powered American tanks and the "diesel-engined panzers" is sheer nonsense: German tanks in Tunisia were all gasoline-powered and there were no diesel-engined German tanks in the field during any other period of World War II.

Fourth, the implied conclusion that the tanks of World War II were not so bad, after all, because the Germans were ultimately defeated strikes a note of that dangerous complacency against which Colonel Rigg so rightly warns in his review of *Nuclear Tactics* in the same issue. The final victory proves nothing about the qualities of the opposing tanks because the war was not fought with tanks alone and it would be far nearer the truth to say that the successes of American Armor in the latter part of World War II were achieved in spite of—and not because of—the undergunned tanks with which it was equipped.

RICHARD M. OGORKIEWICZ

12 Leconfield Ave.
London, S.W. 13, England

Radio Free Europe

Dear Sir:

Thank you very much for your courtesy and thoughtfulness in sending us a copy of your March-April issue.

We were greatly impressed by the fact that you had devoted a double page editorial to the work of the Free Europe Committee. We have given this issue a maximum distribution amongst our staff.

It is a pleasure to tell you that we make it an important part of our public relations activities to invite U. S. Service personnel to our Munich head-

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1959 by the United States Armor Association.

Reprint Rights: All Rights Reserved.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of Armor is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1757 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the even months of the year: *i.e.*, Dec. 25 for Jan-Feb issue, Feb 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

quarters, and to visit groups in outlying installations for the purpose of giving complete briefings on the operations and aims of this organization.

Your editorial is heartening also, because it shows a thorough understanding of the fact that we face a common enemy and that the battle front cannot be defined in military terms alone.

May it find many readers!

DAVID F. GROZIER

Radio Free Europe
Free Europe Committee Inc.
One English Garden,
Munich, Germany

Little Joe

Dear Sir:

The omission of an auxiliary engine-generator (Little Joe) in the M60 Tank has been questioned by Lieutenant Colonel D. S. Cason, Department of the Army, Washington, D. C., in the May-June 1959 issue of *ARMOR*.

Several important considerations led to the decision *not* to use an auxiliary engine-generator unit in the M60 Tank. These were, in order of importance:

1. Range Increase
2. Repair Parts Elimination
3. Maintenance Effort Reduction
4. Availability of a Proven Engine
5. Idling Generator Capacity
6. Noise and IR Reduction

The *range* of the tank was increased about 20 percent by using the space formerly occupied by Little Joe for fuel. *Repair Parts* would be added to the supply system by use of a new auxiliary engine in the M60 Tank. Little Joe added over 400 "G" group repair parts into the system. *Maintenance* of the M48 auxiliary required more effort than the main power plant. The increased durability of the Compression Ignition engine will decrease the maintenance, which will again be cut in half by the omission of one engine.

The small air cooled diesel *engines* now *available* have not been proven in the vehicular application in which they are subjected to vibration, shock, dust and close confinement.

Engines of this type are in test or otherwise being studied by the Ordnance Tank Automotive Command for other vehicular application; however, most of them are very heavy and bulky.

Sufficient output is obtained from the generator when the 12-cylinder engine is idled at 750 rpm. The fuel consumption is lower than for any tested auxiliary engine. This idling does not cause significant wear of the 12-cylinder compression ignition engine.

Exhaust noise and temperature are extremely low because of the chambering and mixing of exhaust gases and cooling air and because exhaust gases of the compression ignition engine are 300 to 400°F cooler than the spark ignition engine. The IR level will be far less with idling the main engine than with the exposed muffler of the auxiliary engine on M48 Tanks.

HOMER E. HELM

Weapons System Manager, M60
Ordnance Tank Automotive Command
Detroit Arsenal, Center Line, Michigan

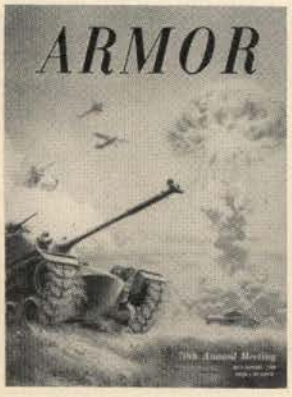
The 70th Annual Meeting

Dear Sir:

I want to express my appreciation for the fine time that I had at the Annual Meeting. This was the first time that I have been able to attend. I enjoyed myself from the very moment that I left Louisville Airport and met fellow conferees in the transportation that Fort Knox furnished. Every individual at Fort Knox went out of his way to make me welcome including those very busy sedan drivers. I do feel that many of the enlisted men of the Association are missing the boat by not attending when they can. I can assure from my own experience that we were made most welcome. Looking forward to another good year for Armor and the Association.

MSGT OWEN F. DEWSBURY

U. S. Army Recruiting Station
Anderson, Indiana



THE COVER

Our deep appreciation to the well-known military artist-illustrator, Mr. William M. Conn, for giving us permission to use his excellent painting as our wrap-around cover. Mr. Conn, retired from the U. S. Army, is still employed at the Field Reproduction Plant, USAARMS. His painting depicts the 182 years of history of the mobile arm.

Tank Company Commander's Guide

By Majors Moore & Brier

This pocket size booklet can be carried for reference. It is designed to assist the company commander in setting up an efficient administrative organization by delineating the responsibilities and duties of all key company personnel and to provide certain other aids and administrative techniques which experience has proven sound. This booklet will prove to be a valuable aid to company commanders.

Paperback **.50**

Notes on the Training of an ARMORED DIVISION

By Maj. Gen. H. H. Howze

These "notes" do not purport to be a complete treatise on the training of Armor. The manner of that training is specified in official manuals. However, it was found very desirable to supplement the manuals with this series of *Notes on the Training of an Armored Division.*

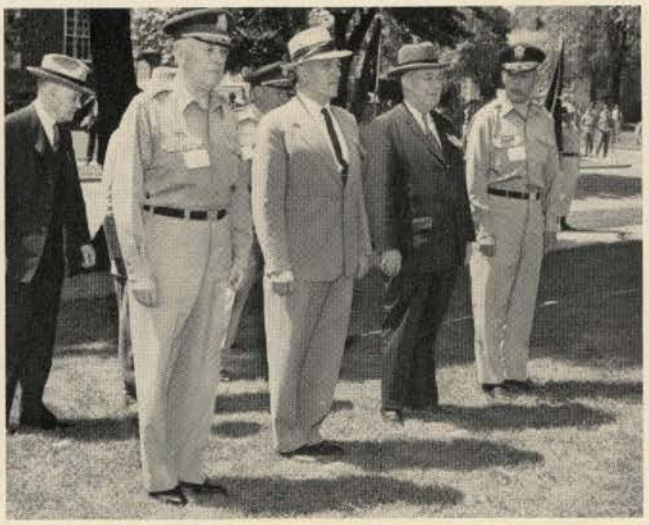
Paperback **.75**

1888-1958

The 70th Annual Meeting of the United States Armor Association was held during the period 7-8 May at The United States Army Armor Center, Fort Knox, Kentucky. The program highlight was the Keynote Address, delivered by The Secretary of the Army, The Honorable Wilber M. Brucker. The theme: "Firepower, Mobility and Shock Action—Today and Tomorrow," was the focal point of

The Seventieth Annual Meeting of The United States Armor Association

The Secretary of the Army, Wilber M. Brucker, right, inspects Honor Guard at Godman Army Air Field, Fort Knox, Kentucky with Captain George Jones, the Honor Guard Commander, and Major General W. P. Johnson, CG, USAARMC.



General Bruce C. Clarke, CG, CONARC, General Willard G. Wyman, Retired, The Honorable Dewey Short, Major General W. Paul Johnson, CG, USAARMC, and Major General Guy V. Henry, Retired, left rear, at the Honor Ceremonies.

70th Annual Meeting

a feature folio . . .

Report on the Annual Meeting by The Secretary 6

Message from the President of the United States 9

The Keynote Address 10

Strategic Aspects of Firepower, Mobility and Shock Action—Today and Tomorrow 15

Some Thoughts On Armor of the Future 19

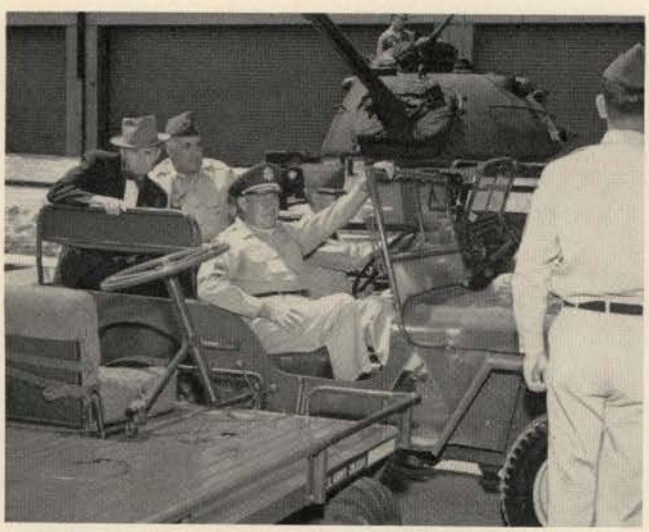
Armor Mobility—A Challenge to Industry 25

Army Missiles and Space Technology 28

The New Council 31

Salutes From Around the World 32

U. S. Army photographs



Congressman Frank Chelf (Ky.), left, foreground, accompanied by Lieutenant General George W. Read, Jr., right, Commanding General, Second U. S. Army and President of the U. S. Armor Association, shown visiting the equipment.

Major William Brown, left, Canadian liaison officer at Fort Knox, Colonel A. James Tedlie, center, Commandant of the Royal Canadian Armoured Corps School, and Major General Worthington, right, shown inspecting a Convair lobber.

Submitted herewith to the membership is the Secretary's report covering the general activities of the Association's 70th Annual Meeting.

(U. S. Army)

Report on the Annual Meeting by The Secretary

THE 70th Annual Meeting of the U. S. Armor Association now joins its illustrious predecessors in the annals of history. Assembling more off-post personnel than any preceding meeting and exceeding last year's previous high by some 50 people, it was indeed a festive affair. From the opening honors at 1100 hours on Thursday, the Seventh, to the concluding buffet in the Commanding General's garden, Friday evening, the Eighth, time was filled with professional presentations and social activities.

In Attendance

Of the more than 300 off-post persons in attendance, the following represented the Executive branch of our government: The Honorable Wilber M. Brucker, Secretary of the Army and our keynote address speaker; The Honorable Dewey Short, Assistant Secretary of the Army for Manpower, Personnel and Reserve Forces; Dr. W. H. Martin, Chief, Research and Development, Department of the Army; and the Honorable Paul E. Feucht, Deputy Assistant Secretary of the Army for Logistics. From the Legislative branch we were privileged to have with us for the entire two days The Honorable Frank Chelf, Congressional Representative from the 4th District in Kentucky. Fort Knox is located in this district.

Some 44 Generals traveled to Knox for the meeting. These were: Generals Bruce C. Clarke, CG, CONARC, and Willard G. Wyman, Ret., Association President during 1957-58. Lieutenant Generals Clovis E. Byers, Department of Defense; W. D. Crittenberger, Ret., Association President, 1950-1953; Geoffrey Keyes, Ret.; W. H. H. Morris, Ret.; George W. Read, Jr., CG, Second U. S. Army, and re-elected Association President; and Walter L. Weible, Ret., Executive Vice-President of the Association of the U. S. Army. Major Generals R. Allen, Ret.; J. W. Bowen, ACS/Reserve Components, D/A; R. W. Curtis, CG, II Corps; L. R. Dewey, Chief, Army Audit Agency, D/A; E. G. Farrand, ODCS/OPS, D/A; Guy V. Henry, Ret., Association President, 1930-34, and present Honorary President; L. V. Hightower, WSEG,

DOD; H. W. Johnson, CONARC; C. P. Kerr, CG, 49th Armd. Div.; N. M. Lynde, Jr., CG, OTAC; J. C. Macdonald, Ret.; D. W. McGowan, Chief, Army Div., NGB; S. L. Myers, ODCS/LOG, D/A; A. C. O'Hara, CG, 27th Armd. Div.; T. S. Riggs, CG, VI Corps; M. C. Snyder, CG, 48th Armd. Div.; A. H. Stackpole, Ret.; J. K. Waters, CONARC; E. G. Wheeler, CG, 2d Armd. Div.; J. J. B. Williams, TAG, Kentucky; E. O. Wolf, CG, 50th Armd. Div.; and F. F. Worthington, Canadian Army. Brigadier Generals J. A. Barclay, CG, ABMA; C. G. Dodge, L&L, D/A; E. F. Easterbrook, CG, Army Aviation Center; W. K. Ghormley, CG, Rock Island Arsenal; G. Hayden, CofS, Fourth U. S. Army; F. S. Henry, Armor Branch, OAD, TAG, D/A; S. R. Hinds, Ret.; G. R. Mather, ODCS/PER, D/A; J. A. Richardson III, CG, Frankford Arsenal; P. M. Robinett, Ret.; H. H. Semmes, Ret.; H. Snyder, ADC, 2d Armd. Div.; H. B. West, ADC 49th Armd. Div.; and F. F. Wing, Jr., CCA, 1st Armd. Div.

On-post General officers in attendance were: Major Generals R. J. Butchers, CG, USATCA; and our genial host, W. Paul Johnson, CG, U. S. Army Armor Center, and Brigadier General G. W. Coolidge, Deputy Post Commander, Fort Knox.

In addition to those named, industry and the press were well represented. Also many of the Armored Division Associations and the World Wars Tank Corps Association sent representatives. We are pleased to state that there was a representative group of senior noncommissioned officers who attended the two-day session.

Following honors and lunch, where General Johnson welcomed the assembled group to Knox, we moved to Theater No. 1 for the business meeting.

Business Meeting

The meeting was called to order as required by the constitution, by the President, Lieutenant General George W. Read, Jr. After the Secretary read the call for the meeting, he stated that the constitutional requirement for a quorum had been met in that there were 1282 absentee ballots and 293 members present.

A motion and second to dispense with the reading of the minutes of last year's meeting was carried. This was favored in view of the fact that these minutes were published in the July-August 1958 issue of *ARMOR*. (See pages 4-21.)

The First Four Months of 1959

An auditing committee appointed by the President examined the books and reviewed the annual report for the calendar year 1958. This report was published in the March-April 1959 issue of *ARMOR*. (See pages 14-16.) However, the President asked the Secretary to give a brief summary of the first four months of 1959 to bring the membership up to date. The report follows:

The first four months of 1959 have been busy ones for your Association. The first two issues of *ARMOR* contained 64 pages each. During the interim months we distributed our two Newsletters.

Our receipts for membership and unit subscriptions for this period are higher than a similar period during 1958. Our expenditures, however, have been higher during the current period as compared with last year. (A new Addressograph machine was purchased in February, and a much needed new typewriter was obtained. This modernizes our office equipment and will in the course of time speed up our operations.)

We are in the process of altering our expiration notices, a change which we believe will streamline our renewal operations. It is a pleasure to report that renewal percentages have increased which assures us of the continuing worth of the Association and its products.

During the summer months we intend to contact the commanders of all Armored units and ask them to put on a promotional drive in order to increase the size of the membership. We also are endeavoring to visit many of our Reserve component units during their annual active duty training periods. In addition to promoting membership, we are desirous of obtaining material for publication. This includes news-type items as well as articles which might materially assist other units in their training.

Due to the many organizational changes in armored units, we are anxious to obtain material from commanders of converted units which will benefit the membership. An example of this type material is the excellent article which appeared in the March-April issue on *Artillery in a ROCAD Division*, by Brigadier General William F. Ryan. (See pages 4-11.) We also believe the articles by Colonel Beall, on *Revisions to ROCAD* (in the same issue; see pages 48-51), and the *Armored Cavalry Regiment* which appears in the May-June issue (see pages 5-7) are of particular benefit to our members.

Book department receipts likewise are higher than a year ago. This can be attributed mainly to two current best sellers: *Tank Commander's Guide*, prepared by the U. S. Army Armor Human Research Unit located at Fort Knox, and General Robinett's new book entitled *Armor Command*.

During these four months, we have increased our awards. A package of books and a one-year membership were given to the top graduate selecting Armor from each of the 165 General Military Science ROTC institutions. Where there was not a graduate selecting Armor, we advised the PMS&T to give the award to a top graduate selecting another combat arm. In addition we awarded books and memberships to the six colleges still retaining the Armor program. The 53 West Point cadets choosing Armor this year were similarly given awards in addition to letters of welcome into the branch from the Association President and the Secretary. We continued to give books, letters of welcome and a set of Armor insignia to OCS graduates choosing Armor as their branch.

From letters received from various PMS&Ts and some of the recipients we feel that we are accomplishing a great deal in promoting Army and Armor relations at the college and pre-commission level. Some of these letters appear in the May-June issue of *ARMOR*.

In the September-October 1958 issue we published an excellent editorial by a young officer entitled "My Task—Protecting America's Freedom." Demands for reprints of this outstanding piece were so great that we reproduced it in two sizes: One size is suitable for framing and the other size fits in a man's pocket. We distributed copies to all PMS&Ts, commanders of major Armor units, and wherever we felt it could be used to promote *esprit* in the Army. Additional re-

quests have poured into the office which assures us that our members appreciate this project. (There are still some copies on hand which we will send out on a gratis basis upon receiving your requests.)

In summary, we are pleased with our progress for the first four months. We are also anxious to expand so we can increase our benefits to our membership. These benefits include more pages in the magazine and increased awards to worthy recipients if available funds permit.

As your Secretary-Treasurer-Editor, representing your four-man staff, we are pleased with our progress to date. We know with your assistance we can continue to grow, making the year 1959 the biggest since World War II.

It is an honor and a pleasure to serve you.

Following the reading of the report, the President stated that the officers and members of the Executive Council had been exceedingly helpful to the Secretary in obtaining material for the magazine and newsletter, guiding the business activities and obtaining new members and unit subscribers. In the latter category, obtaining new members and unit subscriptions, General O'Hara of the New York National Guard and General Wolf of the New Jersey National Guard have done a great deal to increase the membership. This support is appreciated by the entire membership.

Election of Officers

Prior to turning the meeting over to the acting chairman of the nominating committee, the President asked for a motion to dispense with the secret written ballot. This being passed, Major General D. W. McGowan, member of the nominating committee, assumed the chair.

General McGowan first presented the reasons in selecting the members for the proposed slate. He stated the desirability of having a large proportion of members in the Washington Area in the vicinity of the Association's headquarters; some members are being rotated in order to allow other members to become acquainted with the business activities of the Association; due to the preponderance of Armor in Europe, two representatives were chosen from that theater; some members will move prior to the next Annual Meeting, hence are being rotated; and adequate representation was selected from all components to include the Active Army, Army Reserve and National Guard. The Secretary read the proposed slate and it was unanimously adopted.

General Read expressed his appreciation to the membership on his re-election. He then read messages of greetings to the membership from the President of the United States and Armor personnel stationed around the world who were unable to be present. In this latter category were three messages from former Association Presidents: General Williston B. Palmer, 1955-57; General I. D. White, 1946-47; and Lieutenant General Willis D. Crittenberger, 1950-53, who did not arrive at the meeting until the second day. There being no further business the meeting was adjourned. However, the newly elected officers and council members remained for a short meeting. At this time several business items were discussed and the Secretary-Treasurer-Editor was reappointed. The constitutional requirement is that the council must appoint the Secretary-Treasurer and/or Editor prior to the end of the month in which the Annual Meeting is held.

Noted Speakers

The first of four outstanding presentations was next on the agenda. Mr. George Fielding Eliot, noted newspaperman and radio commentator, spoke on the "Strategic Aspects of Firepower, Mobility and Shock Action—Today and Tomorrow." (See page 15.)

Next Lieutenant Colonel Robert B. Rigg, noted author on Communist armies and future methods of warfare, and currently stationed at Fort Knox, presented "Some Thoughts on Armor of the Future." (See page 19.)

A tour of the U. S. Army Armor Board was next where we saw on display many new items of equipment. Some of these items are under test at Knox and others were sent there by the various technical services. We, the Association, are deeply grateful for their support in this project.

The Association banquet closed out the first day's activities. General Read introduced the dignitaries at the head table. We were privileged to hear a few remarks from Congressman Chelf at this time who praised Fort Knox and its leaders. He also gave a special tribute to our Secretary of the Army, Mr. Brucker, for his devotion to duty in his high position in the government. General Bruce C. Clarke, senior active duty officer present, gave an inspiring talk heralding the individual soldier.

The Demonstration

Friday morning we moved to Dorrets Run Range where we witnessed the Mobile Forces Firepower Demonstration *emphasizing the combined arms team.* The professionals at Fort Knox did a superior job and accolades are due every participant in this show. Not only did they emphasize the combined arms team but they brought the supporting services into the picture as well. From the viewer's standpoint it was a flawless demonstration.

The Keynote Address

Moving to Sadowski Field House some 2300 persons were privileged to hear our Secretary of the Army, The Honorable Wilber M. Brucker, give the keynote address. (See page 10.) In addition to praising the United States Army soldiers stationed around the world, he asked for a round of applause for General Clarke for his dedicated work to the Army during his entire career. A standing ovation was rendered by all present.

The Concluding Speakers

Returning to Theater No. 1 after lunch, Major General Nelson M. Lynde, Jr., Commanding General, Ordnance Tank Automotive Center, Detroit Arsenal, spoke on "Armor Mobility—A Challenge to Industry." (See page 25.)

Next our concluding speaker, Brigadier General John A. Barclay, Commanding General, Army Ballistic Missile Agency, presented "The Army Missile Program and its Transition into Space Technology." (See page 28.)

An informal reception and buffet in the garden at the quarters of our host concluded these two-days' activities.

To General Johnson, his staff and all others who did so much to make this meeting the best to date, we give accolades and our deep appreciation. Professional-wise and from the social standpoint there was never a stone left unturned to make us feel at home. Those of us fortunate enough to be present will long remember this auspicious occasion.

from the President of the United States

The White House, Washington, D. C.

5 May 1959

Lieutenant General George W. Read, Jr.
President, United States Armor Association
Fort Knox, Kentucky

It is a pleasure to send greetings to the members of the United States Armor Association assembled at their Seventieth Annual Meeting.

The theme of your meeting exemplifies the fast, hard-hitting tradition of your service. The skill and courage of the men of Armor are an essential part of our Nation's defense forces.

Congratulations and best wishes.

Dwight D. Eisenhower

The Keynote Address by

The Secretary of the Army . . .

(U. S. Army)

By HON. WILBER M. BRUCKER

before the United States Armor Association

IT is a great privilege to join with the membership of the United States Armor Association in this inspiring 70th Annual Meeting. Secretary of Defense McElroy deeply regretted that circumstances forced him to cancel his appointment to be with you on this occasion. He has asked me to express to you his sincere best wishes.

We come together during a period of crisis which has momentous import for every American, and especially for every member of our great Army team.

I know that there is little need to describe to this audience the magnitude and nature of the ever-present and increasing threat to the security of the United States and the Free World. It is sufficient to my purpose merely to remind you that the Soviet Union is expansive and resourceful and has a wide range of military as well as political, economic and psychological capabilities. As a result of these diverse capabilities, the United States is confronted with a multiple threat. We must be prepared to cope with a whole spectrum of conflict with cold war in all its ramified aspects at the lower extreme, shading into so-called limited wars of varying size and intensity, with total nuclear war at the upper end of the spectrum.

I agree with the view that a general nuclear war fought to its inevitable conclusion would be disastrous. However, in the present situation, with an abundance of mighty retaliatory weapons on both sides of the line, it is illogical to believe that the Soviets would invite the almost certain destruction of their own country by intentionally launching a general nuclear conflict.

We must regard lesser aggression, with a succession of limited, attainable objectives, as by far the most likely form in which they might employ their military power.

It should be obvious that failure to deter or deal with these lesser wars, by which the Communists could nibble away the whole Free World; or to prevent the deterioration of our alliances through successful ballistic blackmail, in the long run could be as deadly to the interests of the United States and all free peoples as failure to cope with the threat of all-out nuclear war.

The integrated capabilities of the Army, Navy, Marine Corps and Air Force must be such that the Soviet Union can find no type or level of warfare in which it has sufficient advantage to justify military aggression. In other words, our answer to total aggression must be total deterrence.

Developing and maintaining adequate military forces to cover the present spectrum of possible conflicts is not a simple matter of choosing between the atomic bomb and the rifle. Rather, it is a matter of arriving at a balanced division of resources to provide for flexible forces capable of making a variety of responses. This decision requires a continuous monitoring of the capabilities and limitations of each type of forces in order to insure that no gaps are left in our security posture.

For example, forces designed primarily for massive nuclear retaliation differ qualitatively from those designed for other forms of war. Essentially, long-range retaliatory forces exist for only one purpose,—to deliver large yield nuclear warheads on selected targets. Such forces are essential in total nuclear war and in the "almost" unrestricted forms of war; but their utility is circumscribed, and their efficiency falls off rapidly as further restrictions are applied.

The degree of force they represent is not appropriate in the lesser forms of war and in cold war. Their utility is limited primarily to the threat of their use—a threat which has become progressively less credible in this era of mutual deterrence. Moreover, there is an upper limit to the size and number of forces needed for the effective deterrence of general war. Continuous expansion of such forces beyond the optimum required to engage selected targets simply does not make sense. The ability to "over-kill" does not contribute to deterrence. If anything, expansion beyond that required reduces our over-all deterrent effect because it absorbs resources needed by other elements which contribute to the general war deterrent and by forces which can be employed in cold and limited as well as general war situations.

Most obviously, retaliatory forces are ineffective against indirect aggression so common in recent months. Where, for example, can a megaton weapon be placed so as to insure the stability of a friendly government? President Eisenhower emphasized the necessity for military capabilities tailored to the purpose they are to serve when he declared, in discussing our response to the Soviet threat to Berlin: "I don't know how you could free anything with nuclear weapons." He went on to draw a very cogent analogy: "You don't," he said, "throw hand grenades around streets to police the streets so that people won't be molested by thugs."

During the past year a number of situations have threatened in which only conventional weapons, or missile weapons deprived of their nuclear warheads, would have been useful and efficient means of applying firepower or making deterrence effective.

While the usefulness of long-range retaliatory forces remains quite restricted, the need for modern and flexible forces,—land, sea and air,—spans almost the entire spectrum of war.

In cold war, preventive deployments have a stabilizing influence. The physical presence of armed men on the ground, which furnishes tangible evidence of our determination and capability to defend our freedom, deters infiltration, guerrilla action, subversion and innumerable other forms of conflict not involving overt international hostilities.

In limited war, an army can deter aggression, or meet it with selected force calculated to end the conflict quickly, or can localize and restrict it. In any conflict, there is always the seed of total war, particularly if nuclear weapons are used, and the conflict must be localized and restricted as rapidly as possible to prevent its expansion. Therefore, precision in the application of nuclear force is essential; and the Army's requirement for tactical weapons in the fractional KT range assumes an increasing importance. Such weapons delivered by short-range systems are far less likely to trigger total war through miscalculation than larger nuclear weapons delivered by systems which are linked in everyone's mind to an all-out conflict.

The utility of the Army in total nuclear war has come to be submerged in the public mind by the emphasis which has been placed upon the initial nuclear exchange. Thus, there is a tendency to look only as far as the appalling destruction and chaos of the first few days of a total nuclear war. But the nuclear exchange will not necessarily end the war. Further actions will have to be taken by the belligerents if either side is to establish positive control. These actions may vary from hasty recovery measures to strengthen the national position in peace negotiations, on up to major offensives to seize and occupy hostile territory.

Thus, the requirements for ground forces with respect to general war are clear. First, to contribute to deterrence by providing for forward deployments and for continental air defense, as well as being prepared to give emergency assistance to civil authorities to the extent resources permit. Second, during and immediately following the nuclear exchange, to hold vital areas and prevent the overrunning of substantial portions of the Free World. Finally, in the subsequent phase, to conduct offensive land operations in order to defeat enemy military forces, liberate areas which have been overrun, and impose physical control on the enemy homeland. All these tasks require Army units and the last two—liberating areas and imposing control—can be performed *only* by ground forces.

The ability of the Army to carry out its mission sucessfully is one of the most important factors of our national security. As members of the Army, we can be proud of what is being accomplished throughout our whole organization to make it ready for whatever tasks, of whatever magnitude, it may face in the critical years to come. We can see on every hand the results of dynamic thought, unremitting research, and positive, energetic action within every branch of the service, which give the Army as a whole the means to be the fastest moving, hardest hitting Army in the world,—a military force of incomparable power and versatility.

We have only to consider the unprecedented requirements of the nuclear battlefield to realize the continuing importance of Armor in future ground combat. Enemy use of high or low yield nuclear weapons will demand the utmost in mobility, firepower and protection against atomic effects. The tank meets all of these requirements better than any other ground weapon.

The tank's shape, construction and armor protection minimize both the thermal and blast effects of an atomic explosion. Its antitank capability, reaction time and mobility make it the ideal weapon to achieve decisive successes in offensive roles, especially in making deep penetrations in the exploitation phase of an attack. Since the tank promises to be a weapon of greater use than ever, the Army continues to view it as one of its primary weapons, and the armored unit as an indispensable component of any mobile striking force. Following this conviction, we have provided for a tank battalion of five companies in the Infantry Division, four tank battalions in the Armored Division, and for additional tanks in the Armored Cavalry Regiment and in Armor Groups.

We do not dare forget for a moment that the Soviet forces in East Germany, which constitute the greatest immediate threat to our security, are built around Armor. Half of the divisions comprising these forces are basic tank divisions, while the remaining half is made up of motorized rifle divisions having organic armor.

The characteristics of the Russian family of tanks are well known and appreciated. We intend to have a main battle tank in production as quickly as possible which will be superior to all of them,—the new M60 medium tank, successor to the present Patton M48A2. This tank, as all of you know, will have a 105mm gun and ammunition system capable of defeating any modern tank, and its armor will provide greater crew protection. A new diesel engine will increase its operational range and thereby offer considerable relief for the familiar logistical headache of the armored unit.

We do not intend to stop with this M60 medium tank. A new program of research and development is already under way which emphasizes improvements in propulsion, weapon and protective systems so that our tank of the future will be lighter, burn less fuel, make less noise and have increased radiological protection. We also want this future tank to have a greatly improved "hit and kill" capability. To this end we have given high priority to the incorporation of a direct fire, guided missile-type weapon system in the next generation of tanks.

The question is frequently raised whether or not the present allocation of national resources to defense purposes provides a proper balance of forces. This is one of the most difficult problems confronting top-level military planners today. In answer, I would first emphasize my agreement that a potent nuclear capability is essential. It must be given a high priority in our national defense posture. But I also must stress that we dare not be so blinded by our need for massive retaliatory forces that we neglect the equally essential forces,—land, sea and air,

—which we must have to deter general war and to respond to less than all-out conflict with the approximate degree of measured force.

In a military sense, we must remain in a defensive attitude until war is forced upon us. This is inherent in our form of government and way of life. We cannot think in terms of preventive war. Adherence to such a philosophy would force us to discard our way of life, our moral principles and our ultimate national objectives. We want to preserve our Nation and our way of life. Therefore, again in a military sense, we must continue to develop and improve the classic strategy of active defense, —not passive containment. In doing so, we must maintain the military strength capability which endows our diplomats with the backing they need.

We cannot be satisfied with a limited war capability of "non-controversial" dimensions. In other words, we cannot, just to avoid an argument, take a chance by settling for a capability which we merely hope is great enough to do the job that has to be done. If there can be any reasonable question about its adequacy, it is *per se* too little. No more vicious idea has ever been voiced than that the United States cannot afford whatever is required to make certain of the adequacy of its military preparations. We must afford to be right because we cannot afford to be wrong.

If military deterrence is to be effective, the communists must know that we are prepared for every eventuality. They must be so impressed by the quality, strength and versatility of our Armed Forces—and the firmness of our determination to use them if need be—that they know beyond the shadow of a doubt that they could not profit from military aggression in any form.

It is of equal importance that our allies be certain not only that we have the military capability to deal with any threat without destroying them in the process, but that we possess the moral stamina to stand up for what we profess, no matter what the consequences.

The United States Army is a major element of the greatest mutual security structure ever created. You realize how stupendous are its responsibilities when you glance at a world map and contemplate the vast global spread of our Army deployment in more than 70 countries, and America's defense commitments embracing 45 nations from Korea eastward to Pakistan, and from Iceland to the southern tip of South America.

Army troops in critical areas of Europe and the Far East are essential to the effectiveness of our military posture in a period of tension—a ready deterrent to either limited or general war. The picture presented by our troops standing shoulder-to-shoulder with stalwart allies gives a feeling of solidarity, unity of purpose and determination which can be achieved in no other way. The United States is best known to millions by the American soldier, and he is doing a splendid job of cementing friendships between peoples. Upon his efforts depends in large measure the realization of our desire to build solidly for peace.

The firm stand taken by the United States in the face of communist provocations or outright aggression in Greece, Korea, the Taiwan Straits, Lebanon and West Berlin has inspired faith in the hearts of millions who look to us for leadership, and has made a profound impression upon the peoples of the uncommitted nations who, in the not too distant future, may wield the world balance of power. We have demonstrated our steadfast adherence to the principle that armed force shall not be used for aggression anywhere on earth. We have proved beyond the possibility of an honest doubt on the part of anyone that we will not submit to a "shakedown" by the Sino-Soviet conspirators, that we will not betray those who trust us, that we will not abdicate our rights, nor shirk our solemn responsibilities in any particular because of communist threats and denunciations.

Of course the eyes of the entire world are focused upon Berlin today. When the Soviet leaders issued their ultimatum on Berlin last November, they repudiated their solemn obligations, dishonored their agreements, and gave one more indication that they intend to make the process of diplomacy more difficult whenever an attractive and fruitful opportunity presents itself. In creating a crisis there, the Soviets saw an opportunity to divide the nations of the Free World, to throw us off balance, and to destroy Berlin as a symbol of freedom and progress in an area close to their own shackled and impoverished satellites.

In response to the Soviet threat, the United States has made an unqualified commitment on Berlin, formulated in accord with our principal European allies. In a recent radio and television address to the Nation, President Eisenhower declared that we will not recognize the right of any nation to dishonor its international agreements, because such acceptance would make the process of negotiation a barren mockery. He made it clear that we would live up to our covenants. We do not treat solemn agreements as mere "scraps of paper," as do the Soviets. He declared further that we would use any military force necessary to maintain our position here.

Our Army troops in Berlin are tangible proof of our intent and determination to stand by our pledges. They are the comforting evidence to two and a half million West Berliners that we do not forsake our allies.

While Soviet Russia seeks to alter the situation in Berlin for personal advantages, our aims in that city are simple and without a trace of selfish motive. Our objectives are generally defensive, in keeping with our national desire for world peace and in line with our solid position that aggression is an unacceptable means of settling international differences. We seek only to protect our rights and national interests under present treaty arrangements, and to discharge our obligations to the people of West Berlin.

During my recent inspection trip to Europe, I visited Berlin, of course. I found the morale of the American troops there without parallel. They carry their responsibility to their country and the Free World proudly and well.

Their presence and their evident fitness to perform their mission give credibility to the declarations our President and other Free World leaders have made. In fact, in the peculiar circumstances of this crisis, their presence and readiness give more support to our national aims than

all of the nuclear weapons that have yet been stockpiled. They are the proof that our Nation is prepared to make a variety of responses to Soviet threats and challenges, and through this flexibility which they help provide, our statesmen and diplomats will be able to carry on negotiations which may solve this and other problems without resorting to bloodshed and destruction.

The spirit of our Army people in Berlin today is one similar to that of the stalwart pioneers who built our country. There has not been a single request for transfer of an officer, enlisted man or dependent. All of them—men, women and children—seem keenly aware that the eyes of the world are upon them, and they are living up to what is expected of them.

Last February, while top-level diplomats were striving to cement Western resistance against militant communism, a then unknown United States Army corporal was capably demonstrating how well the American soldier in Europe today is prepared to translate international policy into decisive action. When the small convoy which he commanded was halted for illegal inspection by communist sentries just 50 yards short of West Germany on his return from a routine trip to Berlin, Corporal Richard Masiero refused to allow Red guards to enter his trucks. He immediately set up a defense around them and held firm until the Reds backed down.

Corporal Masiero demonstrated that the prized ability of the American soldier to think and act during a crisis in the absence of superiors or of definite orders is still alive and robust.

This type of action—firm and courageous, yet tactful—typifies the high standard of military performance and conduct which I observed among all ranks and in all places during my European inspection.

I had the pleasure of meeting Corporal Masiero while I was in Germany. If I have ever met a typical young American, he is one. He is a young man from your own neighborhood—the kind who would rather play basketball or work at his job than to be separated from family and friends as a soldier in a foreign land—yet the kind of young American who knows that personal preferences sometime have to take second place in this day and time.

I visited Mayor Willie Brandt, whose indomitable courage reflects the character of the people of the city. He is unafraid and is determined that the communists shall not disrupt the life of his city. Existence in West Berlin is as different from life in East Berlin as day from night. West Berlin is a city of hope—East Berlin is a city of despair.

In the course of my trip, I had conversations with the NATO supreme commander, General Norstad, and others. I visited our troops in Germany extensively, and can assure you that the Seventh Army is a truly magnificently trained and ready force. It stands together with our NATO allies as a visible symbol of our intention to honor our obligations no matter what may come.

I visited Italy and was most pleased to see the progress being made in the Italian Armed Forces. From Italy we went to Greece. Here I was surprised and impressed to see in the city of Athens a tremendous amount of building. When I had visited Athens some four years ago it was a city which reflected a lack of hope, and a fear of the future. But this time I was astonished to see literally hundreds of apartment houses being built, and a new spirit that bodes well for the future. While in Greece, I had an opportunity to again meet the Crown Prince, Prince Constantine, a young man whose personality reflects his very fine upbringing. He is obviously the product of a family that is determined that he will not be a spoiled young man. I was particularly happy to have the opportunity to visit with King Paul of Greece.

Next on my itinerary was Turkey, the eastern anchor of NATO. In Turkey I naturally had long discussions with Ambassador Warren and the Chief of the Joint United States Military Advisory Group. I was pleased to see the progress Turkey is making and to feel and to know at first hand that our ally has the reliable will and determination to stand fast, in the event this should be necessary. It is very reassuring to note this fine spirit on the part of the Turks and reassuring indeed to have such a staunch ally. You will be interested to know that I reviewed a Turkish armored brigade. I was gratified to observe the fine state of repair of the tanks and other equipment, and the splendid soldierly bearing of the men.

After visiting Turkey, I went on to Palma Majorca, Spain, where I conferred with the Minister of the Army, General Barrosa, whom I had met in the States while he was here. We had a long conversation and discussed many matters of mutual interest relating to the Security of Free World countries.

In all, my trip was most interesting and helpful. I have been proud of the contributions of the United States Army to the over-all well-being of the Free World, and it is a stimulating thing to get out on the ground, so to speak, and to visit our officers and men, to see at first hand what they are doing, and to receive an analysis of the local situation confronting them and the problems peculiar to their operation. I can assure you that these men are doing a magnificent job.

Every American has a right to take pride in the manner in which Armor, like every part of our great Army, is carrying out its mission as a major element of our Nation's defense in these critical times.

The most famous cavalry and armored exploits in our history have been characterized, above all else, by a singularly high degree of daring and ingenuity. The skills and techniques acquired through years of hazardous and isolated combat operations—such as reconnaissance, screening, harassing and spearheading deep thrusts into hostile positions—called for and developed a type of officer and soldier who became justly famed for his bravery, imagination and resourcefulness.

The perpetuation of quality performance in both war and peace created an *esprit de corps* which contributed immeasurably to a long and honorable record of impressive combat exploits. This spirit, shaped and forged in the wars of our early history and tempered in the major wars of this century, is the priceless heritage of the present generation of Armored soldiers.

Faced now with the need to cope with a more demanding situation than ever before, this Nation and its Army look once again to Armor for leadership in creating and maintaining the formidable military capability so vital to our security. I am confident that Armor will find in its tradition of swift movement and daring action the key to success on any battlefield, no matter what the odds.

Strategic Aspects of Firepower, Mobility and Shock Action—

Today and Tomorrow

By GEORGE FIELDING ELIOT

AT the outset of any examination of American national strategy in these cold war years, we must always remind ourselves that in its military aspects it is a defensive strategy.

That is so because it is not our purpose to seek a military decision in the world-wide struggle between the forces of Communism and those of freedom. It is rather our purpose to prevent the Communists from attempting to gain or even seriously considering a military decision.

Underlying this purpose is the conviction that if international Communism is denied the glamor and prestige of great external successes, its present objective of global conquest will gradually be eroded by internal pressures and will be replaced by legitimate national objectives with which we can live in greater security.

This view was recently expounded with great clarity in a speech at San Francisco, on December 4 last, by former Secretary of State John Foster Dulles in these words:

> To deny external successes to international Communism is not merely a negative, defensive policy. It accelerates the evolution within the sino-Soviet bloc of governmental policies which will increasingly seek the welfare of their own peoples rather than exploit these peoples in the interest of world conquest.
>
> So, in the context of *our* present foreign policy, the mission of the national strategy which serves that foreign policy is to deny external successes to international Communism.

It would be outside the scope of this talk—and far outside the scope of my own competence—to evaluate the political premises on which Mr. Dulles based this definition of our military requirements. He prescribes a military posture for the United States which in itself is essentially defensive, in order to deny the enemy any escape by the use or threat of military force from the otherwise inescapable consequences of the contradictions between Communist doctrine and the ordinary day-to-day needs and aspirations of human beings.

If he is right in his latter premise, then he is certainly right in claiming that the over-all policy is not in itself negative and defensive. But the part which the military forces of the United States are called upon to play in this vast and compelling drama is certainly defensive in principle. If there is to be military initiative it must come from the other side—or so it must seem to those who heed the constant reassertions from high official sources that we will never start another war: that if shooting starts, the other fellow must shoot first.

There is a danger in this reiteration of peaceful intent which should not escape us. We have thought so long and so fearfully of the frightful violence which might be unleashed in the world should a major war be fought with nuclear weapons between the United States and the Soviet Union that we are getting ourselves into a state of mind in which we begin to assume in advance that any use of force may trigger the nuclear holocaust. Hence it is of itself wrong, and especially wrong on the part of the side which uses force first. We have even allowed ourselves to be conditioned into accepting as one of the ground rules of the cold war the idea that the Communists can make trouble by any means that seems good to them anywhere in the Free World, but we must never seek to make trouble for them within the borders of the Communist world, or by the use of force in any other area. Otherwise we might be labeled aggressors and hauled before the bar of the United Nations.

Now it is certainly the condition today, and we must see to it that it continues to be the condition, that a surprise nuclear attack by the Soviet Union against the United States or our allies would result in the nuclear destruction of the Soviet system as a going concern. The manned aircraft of the Strategic Air Command and of our Navy's carrier task forces are amply able to discharge that part of our mission of denying external successes to Soviet Communism *now*. We are preparing other weapons and means in order that no opportunity for surprise attack shall appear tempting to

the Communist leaders in the future.

But this is not the whole of the task that our military forces must be prepared to perform if external successes are indeed to be denied to the Communist states. As long as their present objective of global conquest continues to be cherished, and as long as they are denied any acceptable prospect of achieving it by a major nuclear offensive, they will continue to seek it piecemeal, as exemplified by their past conduct and present attitudes. In these piecemeal procedures, the use or the threat of military force will play a part on their side, and must be countered by adequate opposition on our side. While the initiative remains with them, such operations can be countered only by the application of the principle of mobility.

In peripheral operations in what are called by the geopoliticians the rimlands of Europe and Asia, we can generally expect some advantage from command of the sea and of the oversea airlanes. We do not have to be able to produce enough firepower to oppose the whole firepower of the Soviet or Red Chinese ground forces. We do have to be able to bring enough firepower to the decisive area *in time* to oppose whatever detachment of those forces, or of indigenous forces armed and led by Communists, may be threatening any part of the Free World. This may or may not result in actual combat. Sometimes the *possession* of enough firepower and enough mobility will be sufficient—the shock action being provided by demonstration of the capability and the will to use it. This may be called limited deterrence—making limited objectives too expensive to be seriously pursued by the Communists.

At other times we may have to fight to deny success to the Communists as we did in Korea, where our strategic mobility brought just enough firepower to the Pusan perimeter to hold fast until, from the strategic viewpoint, we could apply decisive firepower and shock action at Inchon. Whether the subsequent follow-through was the best way to exploit the success of that shock action will be variously debated among military men for some time to come, and I don't intend to pick up that hot potato this afternoon.

Certainly in Korea, time was the determining factor. We didn't have too much of it. At one moment during the Pusan defensive phase, General Walker's only reserve was a battalion that had not yet disembarked. We just scraped through.

Gentlemen, such a strategy leaves the initiative to the enemy, so that mobility—global mobility—is the key to success. Time will *always* be the determining factor. Firepower is no good if you can't get it there in time. Shock action will serve little purpose if it cannot be applied at the decisive moment. Nor is the wrong kind of firepower or of shock action of much service.

Thus in the Suez crisis of 1956, nuclear weapons would have been of no help to the British and French. Their failure was due to not applying conventional power *in time*—while they still had their own public opinion with them and outside pressures had not yet built up to oppose forcible action. We could not have used nuclear weapons in Lebanon had we met with forcible opposition—such an act would have been politically and morally unthinkable. But we did act quickly enough to accomplish the desired purpose—the protection of Lebanese independence against a gathering threat of forcible subversion. In both cases, let us note, the decisive military element was the ground combat soldier.

Almost without exception, so far, our experience of limited objective operations in restraint of Communist local aggressions has required, in one form or another, the physical presence of armed men on the ground to stand between the threatened people or community and Communist violence. The only way to get these men and their weapons to the right place in time, so that they can if necessary make tactical application of mobility, firepower and shock action is to possess *in advance* adequate means for achieving strategic mobility —means which are adapted to the time-schedules that may be anticipated.

This of course is an old story to Army officers. But there is more to it than the current stalemate with the Air Force about the predesignation of airlift for STRAC.

We are indeed gradually being pushed in the direction of greater mobility in *all* elements of our military forces. This is an inheritance from geography and from history. The Soviets are denied strategic mobility in the true sense of the word by their land-locked position on the face of the globe and by the land-locked strategic thinking of successive Russian military generations which has resulted from it. All this affects their choice of means and weapons. They can move along their borders and across them for limited distances. But if they want to attack distant targets all they can do is to sit still and throw things. We, on the other hand, can go just about wherever we want to on the sea or over the sea, and in most of that area they can interfere with us only by the use of land-based aircraft or by the submarine, which is inherently a weapon of evasion. It is not by accident that we have begun to develop mobile deterrent systems such as the Polaris missile submarines; and to many minds such mobile systems—which may in future include nuclear-powered aircraft as well as various types of mobile missiles on land and missile-armed surface ships—are vastly preferable as deterrents, to the studding of our homeland with fixed missile bases whose location must become known to an enemy who is preparing missiles of his own, precisely designed to attack such fixed targets but quite useless against moving targets. There seems little reason why we should deliberately adopt the enemy's inherent disadvantage of immobility and make it our own, and I do not think we will go very far along this fatal path. If pursued, it is a path which leads to the immobilization of political and therefore of military decision, as well as of our armed forces. If every enemy challenge must be met by the threat of nuclear war because we have no effective alternative, and if we must live in the knowledge that a forcible response to that threat involves the life of the American people because the enemy must strike first at the bases of our nuclear delivery systems, there will be an increasing reluctance on the part of our political leadership to challenge limited Communist aggression at all.

But to the extent that we shift our course in the direction of mobile deterrent systems, we will begin to realize, not just in the Pentagon and our great military educational centers such as Fort Knox, but in the halls of Congress

and the minds of our people that in mobility must, now as ever, lie the security and the power of an island people, which we are today on this shrinking globe. We shall come to regard freedom of movement on the sea and air highways of the world as essential to our survival, and therefore to regard obstruction of those highways as intolerable.

As this realization grows stronger, we shall adapt our military forces and their weapons and vehicles to make our freedom of movement secure. For this task we have advantages which the great Communist powers cannot match, now or in the foreseeable future.

I know that at this point many of you, who on one stricken field or another have from time to time fought the battle of the budget, will be asking by what miracle the money to do all this can be procured. But a wholly mobile strategy is not as expensive in the long run as a fixed base strategy. The chief quality of a mobile deterrent exercised against a power made immobile by geography lies in its relative invulnerability to surprise attack. It does not therefore have to depend on a margin of survival. Its whole power, or most of it, can be exercised whenever it is called into action. It does not have to be maintained at a level directly related to the hostile volume of offensive firepower.

Once the level of mobile deterrent firepower which is sufficient to inflict unacceptable punishment on the enemy has been attained—for example, the complete destruction of the Soviets' major industrial centers might well be so considered—we do not have to go on building more in order to have enough left over to hit back with after the enemy hits us. Indeed it may well be questioned that the Soviets will think it worthwhile to continue with their ballistic missile program on a massive scale once they perceive that it has little value against the mobile deterrent systems which we are bringing into being; just as they tapered off their long-range bomber program when they saw that our air-defense missiles and early warning system rendered a successful surprise attack with manned aircraft on SAC bases out of the question.

Such a mobile and hence finite deterrent will be a fixed, not a constantly expanding charge. No longer will deterrence eat up the lion's share of our military budget with the lion growing hungrier each year. A considerable additional margin of resources will become available for other forms of military power—the types of power essential for maintaining the global mobility and exploiting the global freedom of action upon which the effective use of the whole system whether for limited war or for nuclear deterrence must come to depend.

The Greek general Xenophon once observed that in the final analysis, the art of war boils down to maintaining one's freedom of action—which includes, as an axiomatic corollary, the capability of denying freedom of action to the enemy. Freedom of action, in this sense, is an objective of Communist policy as well as ours. They wish to be free to act for the furtherance of their purpose of world domination without fear of nuclear deterrence or of locally effective opposition on the ground. Our policy, based on geography and experience, has mobility as its cornerstone. Mobile deterrents make nonsense of ballistic missiles as nuclear delivery systems. Mobile land, sea and tactical air forces, with freedom of action under the shield of mobile deterrence, can deal with limited threats. All this, of course, must be considered in relation to the controlling factor of time—and that includes the lead-time to produce modern weapons systems. The firepower of Soviet ballistic missiles is useless as an instrument of Soviet policy if they dare not use it lest the Soviet state be destroyed by mobile firepower which they have no assured means of engaging. Under such circumstances, to the extent that the Soviets have invested their military resources in these missiles, they have squandered their freedom of action. But to the extent that we invest our military resources in mobility and the exploitation of mobility, we expand our freedom of action to employ firepower and shock action for such purposes, limited or otherwise, as the future may demand.

Mobility and initiative, however, go hand in hand. The one is the instrument of the other. It may be argued that a strategy based on mobility is not the best support for a national policy which abandons military initiative to the enemy. Here again, however, some change may be foreseen as the virtues of mobility become more apparent with the passage of time—indeed anyone who has read (as I have had to for my sins) the various hearings on military policy subjects in the current Congress cannot fail to see the gleams of light on the horizon.

As my old friend General S. L. A. Marshall has said, the exercise of mobility requires first of all a mobile mind. With the broadening of our military vision, the multiplication of military alternatives which expanding mobility—and understanding of what mobility means to us—must bring, our political horizons will broaden too. We shall no longer consider the landing of a couple of battle groups in the Middle East as the prelude to World War III and nuclear bombs on Chicago. Rather we shall see it as a necessary incident in preserving the global freedom of action which is essential to the denial of external successes to Soviet communism and hence one more step toward the final goal of our cold war policy. Furthermore, we shall have the battle groups —or the divisions, if need be—to spare. We also shall have the means of transporting them in timely fashion wherever they are needed, for the same reason—a sensible understanding of the requirements of self-preservation in a world which can be lost to Communism as readily by piecemeal retreats as by unconditional surrender to the nuclear threat.

I should like to say one concluding word on the subject of the inter-service rivalries which are so featured in public discussions of our military policy. These rivalries have their origin chiefly in legitimate anxiety on the part of service chiefs and their immediate subordinates. The anxiety arises from the requirements of a defensive national policy. Any military man who is required to assume the defensive will inevitably seek to hold out as considerable a reserve as he can against the unexpected. But our service chiefs today, find their reserves ground away between the upper millstone of a fixed budget ceiling and the lower millstone compounded of fixed commitments and rising costs. They cannot squeeze out

even a respectable margin of force to deal with the unexpected contingencies which the enemy devises so tirelessly. The value of such reserves as they do have is annually depreciating because of annual postponement (in favor of keeping the budget down *this* year) of prudent replacements of inventories of weapons and equipment. Logical and factual presentations on these points have only temporary effect. The situation can be corrected permanently only as the people of this country become aware slowly and through the logic of events, of the conditions of security in the world in which they live, a world in which—for better or for worse, and whether we all like it or not—the survival of human liberties on the surface of this planet has been given into the charge of the people of the United States. Fortunately for our peace of mind, we have an historical example in the previous experience of the British people. They too had to endure these trials, these hesitations; they too had to learn bitter lessons through the process of trial and error. They too were required, from an insular base, to protect global interests throughout the world and to create military instruments adequate for the purpose. And it was only when the conditions of their survival had become so well understood among them that no political leader or party would have dared suggest neglecting these essentials that the *Pax Britannica* became a term of common use and understanding. So it will be, I venture to say, with the era of the *Pax Americana* upon which, God willing, the world is now entering. That peace will be secured by the application by the American people of the principle of mobility as the key to their military policy, enabling them to employ firepower and if necessary shock action in timely fashion according to their needs and responsibilities.

UNITED STATES ARMY
THE CHIEF OF STAFF

To The Members Of The
United States Armor Association

On the occasion of the 70th Annual Meeting of the United States Armor Association, I extend best wishes for a successful and productive session.

The Armor branch is a modern expression of maneuverability, shock effect, and elan in the best tradition of the Cavalry. The Armor concepts of mobile warfare synthesize those vital ingredients of success in battle—firepower, mobility, and communications. These concepts transcend considerations of branch of service and permeate the latest tactical thinking of the entire Army. The U. S. Armor Association may well take pride in the major contributions which Armor has made in this regard.

Today the Army finds itself involved in an accelerating technological revolution in the means of waging war. This transition provides the impetus for a continuing rapid evolution of our strategy, tactics, logistics, and organization. While we should not discard the valid lessons gained from past accomplishments, all the arms and services must seek aggressively to anticipate the future so that our Army will prevail in any test to which it may be put.

I am confident that the United States Armor Association and its membership will continue to perform a leading and significant role in advancing the techniques and concepts of future mobile warfare to the benefit of the Army as a whole.

MAXWELL D. TAYLOR
General, United States Army
Chief of Staff

Some Thoughts On Armor of the Future

By LIEUTENANT COLONEL ROBERT B. RIGG

GATHERED here on the fulcrum of the space age, we in Armor are entitled to look ahead and anticipate some of the future chances indicated and some of the potentialities promised by technology within the next decade. However, speculating on the future is like playing Russian roulette with five chambers of the revolver loaded. The chances of being correct are slim. Nevertheless, let us look into the phantasmagoria of the era after 1965.

The past history of our arm contains countless episodes of bravery and many daring deeds. But none are more unusual and daring than the group of military men who, having assaulted many objectives, have now taken the formidable heights of Cloud Number 17. But these men of today are in trouble. They need your help and support. They are under fire from the forces of General Conservancy. They are being outflanked, but not outfought by the storm troops of General Complacency. His deputy, General Mediocracy, is leading another task force bombarding our advance forces. If, in the Nation's interest, we in Armor are to advance our arm in the next decade, we must all support our advance guard which is probing the military-technological barrier in the field of research and development. In the arsenals of Ordnance, in the laboratories of industry and in military staffs ranging from Fort Knox to the Pentagon, these men with ideas for tomorrow are calling for volunteers and volunteer ideas. You can assist them in many ways: by technical ideas, by moral encouragement and by all other forms of backing. You may not agree with their specific ideas, but you should agree with their quest —the quest for better weapons for Armor. Let us not delude ourselves. In the next decade, we shall need much better armored weapons and machines if we are to ever oppose successfully, the avalanche of Soviet Armor—or help deter the unleashing of any aggressive military forces.

Prediction, at best, is an uncertain science. So rather than trying to predict things to come, we might better say that here are some of the directions that Armor may take. Since weapons shape military organizations, let us concentrate largely on some combat vehicular concepts and omit discussion of future Armor organization. In the past, tradition often placed weapons in the hands of troops. However, in the future it will be military technology which will place weapons in our hands.

Since the tank is the backbone of our armor combat team, let us take a look at what can logically happen to the tank, sometime after 1965. First off, the amphibious tank is perhaps our most urgent need. The USSR is the only nation possessing one. We need to match this versatile vehicle and outdo it with others.

Over and beyond this requirement, one can easily foresee that the missile and the tank are going to have a courtship. Formal or shotgun wedding, somebody, we or the Soviets, are going to marry this couple in some form of military matrimony.

But perhaps this mechanical matrimonial union will not be compatible —or a stormy romance could produce this harmonious, but curious by-product. Thus, this idea—that of a divisible tank—could emerge in the distant future. Here we see a turret, or a comparable entity with wings, which can separate itself from the tank hull and rise up to hover or fly—and of course, shoot. The hull lobs out its own smoke screen and then jockeys aside from the original position.

Here we have a tank that could perplex an enemy. Which does he shoot first, the turret or the hull.

Now if this tank solution doesn't work out—here is another alternative —the two unit tank. Seriously, there is sophistication to this potential concept because the firing half of the tank can be defiladed, or hidden, from the sighting or aiming half, so that this vehicle-unit need not necessarily disclose its entire self by the flash and smoke of firing.

In a different category there is the

nuclear firepowered tank. This is a potential, but it does not mean that every tank in its company need have this capability.

Perhaps more significant in its potential combat contribution would be this type of vehicle—a nuclear powered tank. Having a tank of this type would mean the end to vulnerable refueling halts, the severing of logistical fuel trucks and tails, and above all, greatly increased cruising ranges for tanks and related armored vehicles. While there is no ultimate tank —any more than there is an ultimate automobile—here is the combat fighting vehicle that could journey from Suez to Sevastopol and keep going.

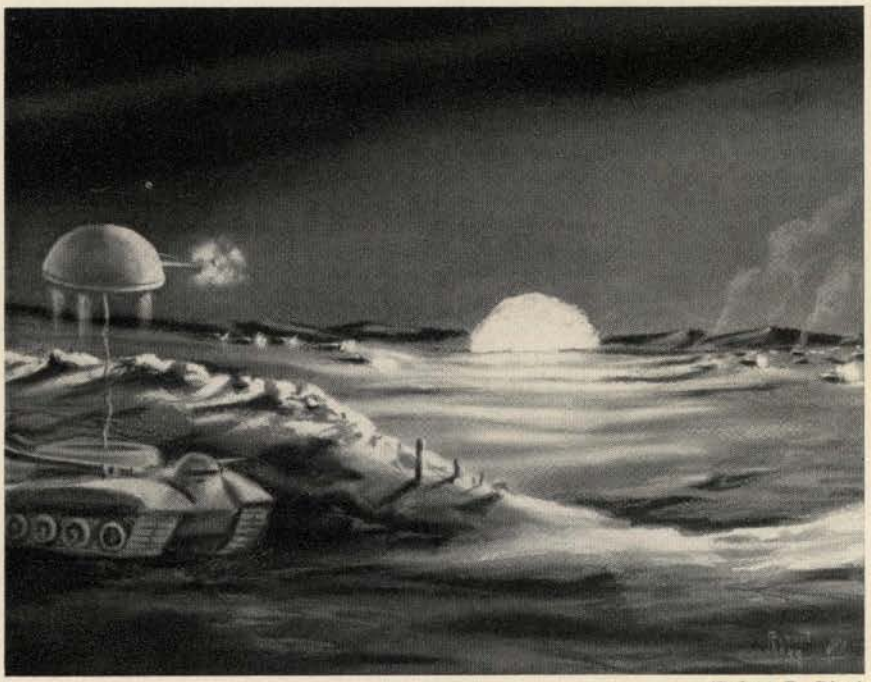
Let us turn to another type tank concept. Suppose, however, the turret we saw earlier cannot be made to glide around beyond its smoke screened hull. Well, here is the tethered turret that lifts its ugly face to fire a salvo and then drop into defilade while the crew in the tank hull hide in relative safety.

Mechanically, this concept could be put together today using a small drone helicopter—armed, of course,— and anchored by cable to an armored personnel carrier or tank turret.

But if the turret is ever to go up, then the hull must go down, and this brings us to the next feature which future armored vehicles must incorporate in some degree. This feature: dig-in ability.

To survive to fight in nuclear warfare, combat vehicles must periodically dig in. Actually, the soil of the earth may eventually offer more protective promise than technology may provide. Thus, track trowels and bulldozer blades could ultimately be common features of armored vehicles.

Self entrenching tanks—or even partially entrenching vehicles—are within the realm of both necessity and possibility. In bivouac or related periodic halts armored vehicles will improve their already excellent protective qualities by the ability to dig in quickly. This does not mean any lessening of mobility, for the vehicles will churn out of a dug-in position as if climbing out of a ditch—the mobility potential is still there.



(Robert B. Rigg)

The tethered turret tank concept.

Now turning forward into a few more pages of possible future history, the planet or satellite-type tank offers another possible potential.

Here you see the potential concept advance of a tethered turret. The turret of this tank is actually a cluster of several small pods which are, in effect, *kamakazi* drones. Singly, or in groups, they are ejected to rise up and dive toward the enemy, homing on hard targets such as tanks. Each *kamakazi* pod would carry a warhead of penetrating high explosive. Thus, one tank with 20 of these satellite pods could engage a superior number of enemy armored vehicles at one time.

Next, we come to the flying tank. But before you slew your turrets in protest to the concept, let us remember that this concept is a very old one. It dates back at least to 1932 when Mr. Christie, a very able tank designer, proposed this model.

This project provided for the construction of tanks with removable and non-removable wings. Since this tank was supposed to have a high landing speed, Christie managed to obtain a speed approaching 60 miles per hour on caterpillar tracks with his model. This marked the appearance of Christie's high speed tank—the machine around which he hoped to build this flying vehicle.

Christie also proposed the suspension of tanks from aircraft, and the Soviets actually tried his proposal out. The first tanks carried in the air were the Soviet T37 and T38 tank models—good amphibious craft to boot. They were slung under the bellies of four engine Soviet bomber-transports during peacetime maneuvers in the 1940 occupation of Bessarabia.

One may disagree in details, but certainly the potential of a tank that is not completely terrain-bound and barrier-inhibited, is what is necessary for the future. We will not forever build on the tank in its present form —and revolution more than evolution is demanded in the development of future armored vehicles.

At this moment I propose to discuss a very unusual tank concept, but let me preface the illustration with these remarks. There is a scientific basis for saying that the melting or disintegration of vehicles is a possibility within warfare of the future. While this may appear astounding at the moment, the principle of "energy concentration" simply awaits more research and later weapon application. The United States Navy has conducted experiments in the fields of high intensity arc sources and solar energy. Additionally, the United States Air Force has conducted high energy radar beam experiments. Based on this work, it is believed that such concepts could be realized with proper basic and applied research in the next decade.

(From "The Mysterians," courtesy MGM)

A concept of a giant tank-mounted energy concentrator weapon.

(Robert B. Rigg)

Energy concentrator weapon, tank mounted.

The energy concentration concept involves the concentration of energy by use of electro-optical surfaces so as to increase the field of density at a given point to a level hazardous to man or machine. In essence, a source of radiation is beamed against an electro-optical mirror which reflects the energy into space. It is known that certain energy concentrations will generate sufficient molecular activity to disintegrate certain base elements and their alloys.

Depicted here, is a concept of a future tank whose main weapon is an energy concentrator which beams its rays upon the enemy.

If such a weapon could melt the armor of a vehicle, then it might easily melt the optics or perhaps just weld the metal hatches and doors, thus sealing the crew of carrier-borne troops inside the vehicle. As a man-killing instrument, a ground equipment immobilizer, or antitank and antiaircraft killer, this is a direction in which some future weaponry might go. Take it, or leave it—the concept has the validity to generate present day research.

Turning to other potentials of more immediate application to Armor, here are some air vehicles which will be a part of the future armor team. Here, in the haze of battle, will be Armor's aerial eyes and ears, seeking and probing to find targets.

Air cavalry's role will not be all "Sneak and peek"—there will be undoubtedly considerable fighting for information as exemplified by this aerial assault vehicle which is saucer-like in form—not unlike the vehicles now under development by the U. S. Army.

Included in the agenda of future vehicles also will be new types of armored personnel carriers. Amphibious and versatile, probably mounting special equipment and weapons on some of these vehicles, future armored personnel carriers and their crews will be fighting alongside tanks and air cavalry to exploit the effects of nuclear weapon strikes.

The other portion of the armor team is represented by artillery, and as time progresses this means missile artillery. We may anticipate that the

ranges of both direct and general support weapons will increase with time. It would appear that at a distant date at least the general support missile artillery will be able to support armored task forces from great distances. In theory, and we would hope that in practice, all artillery ranges will be sufficiently great so that this element of the armor combat team need not operate from the tank and infantry portion of the battleground, but would fire from points well outside it—conceivably at a very distant date, by as much as a continent or country away. Thus, there is the potential of further reducing the battlefield density of troops as artillery missile ranges increase.

Weapon-wise, these, then, are some of the directions and potentials ahead. But before our minds we must keep the vision of the combat barriers which must be better surmounted than in the past. One of these barriers is darkness itself. The quest for better night fighting and moving equipment is already in progress and we may expect that in the next decade our fighting ability in this respect will be greatly improved.

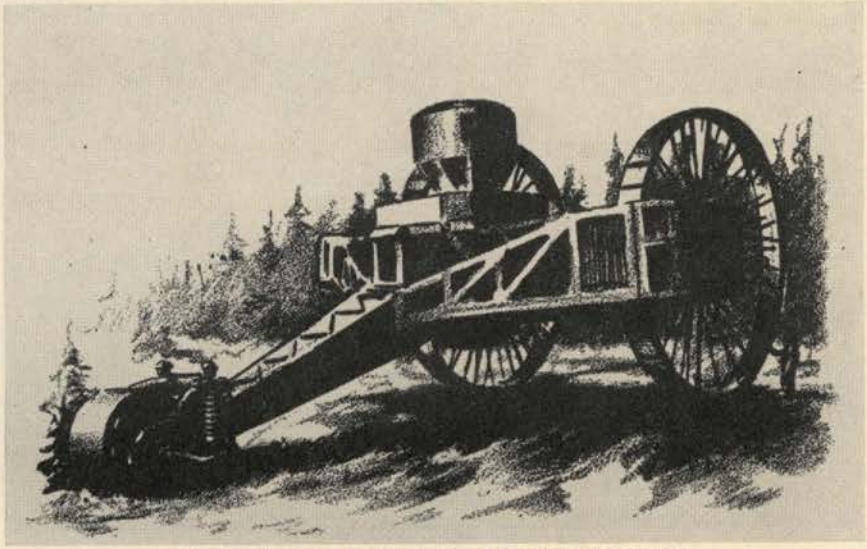
Since enemy forces constitute the biggest barrier in combat, improved firepower means must be sought. Here is one of our most serious challenges. For example, the place to attack enemy tanks is where they are weakest in firepower, visibility and protection. Look down on the top of a tank and here you will find this weakest area. Additionally, the deck and turret top of a tank present the largest vehicular area exposed to attack. Conceivably, the flying saucer assault vehicle you saw pictured earlier may become one of the best tank killers of the future. I recognize that this is a debatable point, but in theory at least, the weapon which can attack a tank from above and get away swiftly—this weapon recommends itself in at least some form to future Armor. Again, we cannot build forever on the tank in its present form. Furthermore, if our military technology can develop such an air instrument of attack—the large inventories of potentially hostile Armor could be rendered into a period of obsolescence—or the nations having them would at least be forced to modify thousands of combat vehicles. Helicopters are already armed in some degree, and we are moving closer to aerial assault type vehicles. Technology offers some promise of progress in respect to materials for such vehicles. For example, magnesium-lithium armor, titanium, special radiological armor and new lightweight structural metals are expected to be much more available and useful after 1965. Magnesium, one of the lightest of all metals, can be made even lighter when alloyed with lithium. From a military point of view, it gives good protection against projectile fragments. The projected application is for APCs, SPGs, the airborne tank and related vehicles, as they are produced. Titanium is likewise adaptable, offering good ballistic protection. Detroit Arsenal programs have been under way to improve its already good characteristics and reduce its cost.

We may also anticipate the automatic welding of magnesium and titanium armor after about 1968. The automatic welding of aluminum and steel armor is anticipated even earlier. Progress will be made in the welding of plastics to metals. Furthermore, research and development work on outer space vehicles is likewise likely to produce some bonus effects and dividends applicable to armored vehicles of the future.

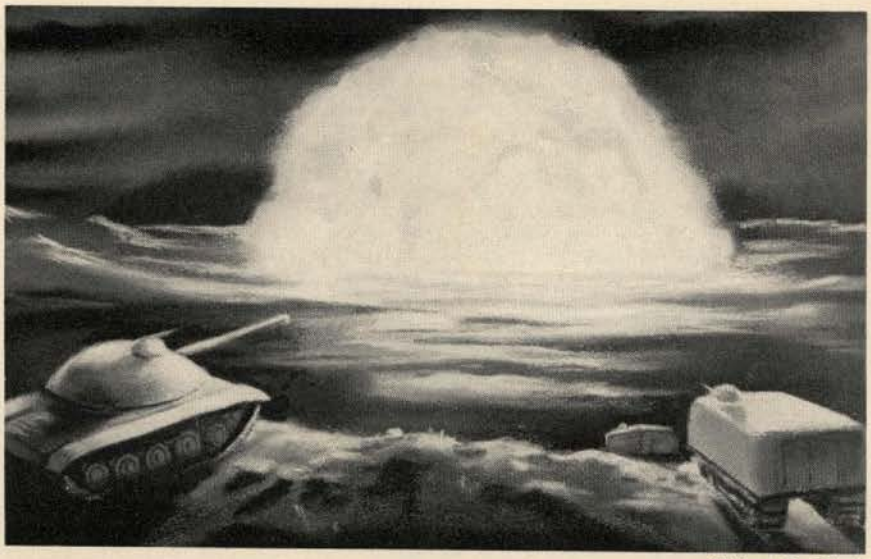
Additionally, developments and progress may be anticipated in respect to plastic, applique, fabric and dynamic armor. So there is reason to anticipate that somewhere late in the next decade there will be materials, yes even exotic fuels, with which to design and fabricate new types of armored vehicles. No one can safely predict the precise format of the tank of the 1970 era.

The crude tank depicted on this page is a Russian tank. Each wheel is powered with an engine of about 240 hp. This tank was tested in August 1915, less than a year after Colonel Swinton made his initial tank proposal to the British War Ministry. However, during its field test this Russian tank lasted one revolution of its big wheels and then dug itself into the ground; but the driver of the vehicle, Mikulin, became a designer of Soviet aviation motors used as late as 1947. This picture is a reminder that imagination and creativeness know no political boundaries.

At this point it would appear safe to conclude that anything in the way of a truly revolutionary tank will probably not appear until around 1968 to 1970. Then a new tank may emerge—possibly a blend of tank and aircraft that will render obsolete as barriers, minefields, mountains and rivers. Such a combat instrument would fit the wide battlegrounds envisaged today because such a tank could fight and cover at least five to nine times the points and distances that the present tank covers in the same length of time today. Consider another aspect. All the powerful weapons of combat will be hunted weapons; electronically and visually, their presence will in the future be scouted out by aerial drones, radars and related reconnaissance means. Thus, one of the problems is to provide for the cancellation, in enemy eyes and scopes, of combat vehicle



Crude Russian tank which was tested in 1915.



(Robert B. Rigg)

Tanks and APCs poised for exploitation of an atomic strike.

signatures. So I would emphasize that the fleeting air-type tank would be an ideal vehicle since it would be one of the hardest vehicles to spot, pinpoint, and target in on.

The armored personnel carrier is also likely to evolve gradually into an air vehicle. Somewhere in the future lies an infantry transport vehicle that will probably be a cross between a helicopter and an armored carrier.

More mobile, more elusive and harder to hit—all of these types of vehicles suggest themselves to Armor of the future, and the air-tank will largely render antitank guns into obsolescence—or at least force their conversion to antiair weapons.

Swifter in arrival, fleeting as a target and thus engendering better survival, all of these vehicles will cover more territory, stay less time in one spot, and disperse excellently in the time and pattern that only speeds of 100 miles per hour or better can provide. Above all, such vehicles would render minefields into the category of cavalry sabers.

It is imperative that at least some United States tanks be designed to meet the Soviet submarine threat. As you know, the USSR has some 450 submarines, a great many more than Hitler had. Unless the weight of *some* American tanks can be reduced greatly, American armor can price itself off future battleground to the detriment of national interest. Obviously, the airborne tank is one answer to the potential submarine threat, because it can transcend oceans and arrive in time to be of great value on the land battleground. However, it is not the sole solution for future Armor. In nuclear combat, if the rim of hell is to be inhabited and fought on, then Armor must be there with weapons that can do the job. Warfare cannot be fought and won by the fleeting shadows of light weaponry alone. It has been necessary, and probably will be for a long time to come, for Armor to retain its schizophrenic or split personality—that of having both light and heavy weapons. If a light tank can do the job of a larger one, then fine. But until then, we must possess weapons adequate to the heavy slugfests of combat. Perhaps we've been a bit on the defensive because we have not had an airborne tank. But let us not permit ourselves to be crucified on this altar. The bullet has grown from a handheld musket ball to a several story high missile resting on a concrete launching pad. Submarines and aircraft have grown larger and larger. And yet amid all of this atmosphere and progress, the tank, by virtue of its size and weight, has become an object of some criticism. So let us stand firm by our guns and tracks on the basis that until technology can produce the jewelled titanium tank, the Nation must possess the combat vehicles necessary to success where the fighting is the toughest. Certainly we are for the airborne tank—but has the hue and cry for such a vehicle been matched by a related quest or program to provide sufficient aircraft to transport them in quantity?

We cannot postulate on the future of Armor without including mention of automation. Digital computers and related machines are bound to improve the arm of Armor. We presently have computers blinking away on tank *versus* tank and related combat engagements wherein even detailed terrain features are fed into these mathematical battlegrounds from maps. Thus, terrain, translated into tape, actually influences tank and other vehicle movements and decisions in these electronic battles. Additionally, we have computer battles which pit foreign antitank guns against our own tanks whose detailed armor thicknesses are examined in terms of protection and vulnerability from every logical angle of attack. Result: today we are scientifically examining the distribution and thickness of armor plate so as to produce better combat vehicles. But what about the future of tomorrow?

Eventually, our combat vehicles are likely to be largely designed by computers. Take, for example, new engine and tank concepts. Instead of building prototypes at the cost of hundreds of thousands of dollars each and consuming precious time, engineers and ordnance experts can construct the concepts mathematically and operationally, "flight test" them in a variety of mathematical tanks, by using a computer. Where there is anything wrong, the computer will reveal it, and changes can be made. When a given future power pack combination operates better than other mathematical models, then we may proceed to a physical prototype. This is a less expensive and more scientific way of going about the developmental job. Additionally, we may foresee that automation will provide automatic target acquisition instruments and navigational aids for armor vehicles, improving their overall fighting qualities and permitting better night and day operations as well as movement.

Now, just as there has been urgent quest and satisfying progress in the field of STOL and VTOL aircraft, so must there be even more urgent R&D exploration in respect to future tank

and combat vehicle design. Conceivably, the tank of the 1965-68 future could be a very low ground carrier mounting a VTOL firing platform ejecting HE rockets and AP missiles—a very elusive but expendable platform put in flight, maneuvered and fired by remote control with the console operator well shielded by an armor vehicle not directly in enemy sights. But whatever the form the future combat vehicles take, it is obvious that the armor team must eventually drop off its logistical tail to achieve true blitzkrieg and present to the enemy the bare minimum in support activity targets. In short, Armor of the distant future must leave a logistical vacuum in its offensive wake. For long range, deep-in operations, the re-supply of armor combat columns by missiles is a future, though distant answer here.

(Robert B. Rigg)

Re-supply of armor combat columns by missiles is a future probability.

There is before us in reality, an acorn to this idea: Already fired with payload, a small supply missile, the LOBBER, has been developed by Convair to provide United States Army units with a supersonic ballistic missile with which to supply troops with food and ammunition.

Current missiles such as REDSTONE and JUPITER, do not at the moment appear attractive for the ordinary re-supply of armor formations engaged in deep-in penetrations. This is by virtue of their present-day cost. However, in the future, the missile costs for supply of Armor may not be prohibitive for emergency military situations wherein the following conditions prevail.

First, where anticipated losses of aircraft or surface transport means are likely to be very high; Here the dollar cost of lost air and ground transport must be added to personnel losses, and the cost—in time and dollars—of the trained pilots, crews and drivers.

Second, where foul weather and terrain prevent aircraft flights from being conducted without risks of undue losses, or enemy missile interdiction of ground supply routes reaches saturation proportions with consequential excess losses.

Third, where speed and surprise are of great value.

Fourth, where reliability is required to meet a series of planned drops of cargo in a vital strategic land operation.

Or finally, where the need to defeat the enemy in the most rapid fashion is vital to the very survival of an entire theater of operations.—For example, this could be a theater or combat zone which might have its strategic supply lines seriously intercepted by submarines and other means to where the re-supply of its offensive elements could only rest on the use of IRBMs and ICBMs as primary logistical vehicles.

Looking to the not too distant future when both IRBMs and ICBMs will be automatically made obsolete by much newer model missiles, these earlier missiles have the possible potential of being modified and equipped with re-supply warheads which could supply armor formations, thereby virtually reducing the logistical tail trailing in the wake of armor combat task forces.

As a military principle and future expediency, it appears conclusive that at the distant date when arsenals of long range missiles become retired into combat obsolescence by virtue of improved weapons, the warheads of these old missiles should be modified into containers for fuel, ammunition and matériel necessary to supply strategic striking forces comprised of armor and airborne units. Such formations penetrating enemy territory on offensive missions could then operate without any real logistical tail (except air evacuation of wounded) when supplied by these missiles, which could range in on accurate CEPs from as far away as another continent —and certainly from relatively shorter distances.

The ideal military ground forces for the future in any type war in the open regions of world continents will be armored task forces supported logistically by long range supply missiles and supported tactically and strategically by missile firepower of related ranges.

In closing, let me say that in these concepts I have drawn on research without being bound by it. Technology alone will not produce the weaponry we will need for the future. Married to technology must be imagination and initiative—yes, even daring. Just as Air Force pioneers dropped propellers for jet engines, so must we be prepared to accept and adopt new concepts. Tradition placed the stirrup and saber in our own hands—but between wars we had an advance guard of thinking men on Cloud 17. They rejected the saber and adopted new concepts. Today, another group of military men are fighting on the heights of Cloud 17. Let's back them up, and be prepared for future changes.

ARMOR MOBILITY

A Challenge to Industry

By MAJOR GENERAL NELSON M. LYNDE, JR.

THESE vehicles you have seen [Goers & Heavy Earth Moving Equipment] are products of heavy industry and this is an important point, because people not familiar with the problems of heavy industry often venture to criticize the development and production of military vehicles. Heavy industry is characterized by expensive special tooling, which inhibits change and places a premium on evolution by product improvement. The mobilization production base held in stand-by and layaway for the tank-automotive commodity aggregated $1.2 billions in June of last year, a cost amortized by vehicle production during and after Korea. The tooling costs of the automotive industry will exceed $1.0 billions for annual model changes, a cost passed on to the customers. Another characteristic of heavy industry is a well established development-to-production cycle of seven years, four for component development and three for vehicle testing and production.

We are caught in this same cycle and it is for this reason that I say look at the components available or under development today, if you would predict the vehicles in production in 1965-70.

Now the enemy has a very respectable heavy industry and for the past 25 years his heavy industry has produced thousands of rugged, effective combat vehicles, making steady progress by means of product improvement, rather than by complete model changes. You all know that if you manufacture a quarter million items, you are bound to be pretty good with all that production experience, and Soviet Armor is no exception.

Add to this, the probability that the enemy will be operating on interior lines and it is plain that our Armor will be confronted by a numerical superiority of very capable fighting vehicles. Industry and the Army must strive to achieve an advantage for our side through the technological improvement of our ground vehicles. Firepower and protection are factors of great importance in this improved technology, but neither can be exploited until mobility has been developed and unless it can be sustained.

Absolute Mobility

I like to express the degree of mobility which we must achieve as absolute mobility, in order to include all the aspects of the problem. Since absolute mobility is a new term, I will attempt to define it.

The first aspect of absolute mobility may be called strategic mobility and represents the passive configuration of the ground vehicle which permits it to be readily transported by bulk carriers, such as cargo aircraft, railways and ships. To rate high in strategic mobility, the ground vehicle should be compact in dimensions, light in weight, and designed to facilitate loading and unloading, including the ability to withstand the shock that may result from air drop.

The second aspect of absolute mobility may be termed tactical mobility and represents the active capability of the ground vehicle to negotiate all kinds of terrain, including floating on inland waters. This characteristic depends on special military design features such as ground pressures, ground clearance, angles of departure, drawbar pull, and the capability of survival in the heat, cold, mud and dust where the Army does its work. An important part of tactical mobility is the capability to range far and wide on a minimum of fuel and a broad appetite for many kinds of fuel.

The third, and to my mind, most important aspect of absolute mobility is logistic mobility. The vehicle in the rear may be compact and light, it may have an economical, multi-fuel engine and be capable of crossing the most difficult terrain, but at the moment it is dead and its mobility is nil, because a mechanical failure has killed it. This problem of logistic mobility is only another way of saying reliability, a requirement with which industry is familiar, but which has not been applied to the development and production of ground vehicles in the imaginative, vigorous manner that is needed. For the time being the tank designers of all nations are limited to the use of six basic systems in the development of their vehicles:

1. High pressure gun-kinetic energy ammunition.
2. Optical fire control.
3. Four man crew.
4. Ferrous armor.
5. Reciprocating engine.
6. Full-track suspension.

Reliance on these basic systems means that the main battle tanks of all nations are roughly comparable with no clearly decisive superior features having been established for any con-

testant. We must realize that a technological break-through in one of these basic systems could set off a chain reaction in others that might lead to a really decisive advantage in vehicle design.

The problem is one of compounding advantages to be gained through design objectives. I believe the first objective is to replace the high pressure gun-ammunition and optical fire control system with a sophisticated missile, launched at low velocity, but capable of seeking out its target and of accomplishing a kill by chemical energy. Having reduced the reaction on gun-trunnions and the amount of optical equipment to be housed, the bulk and dimensions of the turret can be reduced.

Automation and possibly remote control may provide the means for reducing the four-man crew, thus making smaller the size of the compartment to be enclosed in armor and reducing vehicle weight.

Ferrous armor provides little protection against radiation and its ballistic limitations are well known. Recognizing that armor must protect against radiological, kinetic and chemical energy attack, as well as against fragments and small arms, it is apparent that we will use steel in combination with other and lighter materials, or perhaps ferrous armor might be replaced entirely.

As the weight of the vehicle comes down, the size of the engine, transmission and fuel storage will be smaller. The rotary engine or gas turbine will be the ultimate military engine by 1970 because of its inherent light weight, ease of cold starting, broad fuel appetite, long service life and good storage characteristics.

There is no irrevocable reason why the armored vehicle must remain in contact with the ground. A leaping vehicle, or one riding on a cushion of air would be acceptable if it can move cross-country and carry a weapon to kill armor. Certainly as bulk and dimensions decrease many forms of articulation and suspension will become feasible.

One question that always perplexes the vehicle designer is: "What is the value of a pound of weight saved?" I doubt if an absolute answer can be given, but these approximate figures serve to illustrate the point: For a 6000 mile air trip as much as five pounds of fuel would be required for each pound of cargo. And for each pound of cargo about six pounds of air frame is required.

Obviously there is a premium for lightweight vehicles in air-movements. Since reconnaissance and airborne units and Marines are most likely to be involved in air movements, it is apparent that there is a development requirement for lightweight vehicles for these units, even at some sacrifice of protection and durability. This means dual development objectives for ground vehicles, since other elements of the Army and especially Armor are vitally concerned with reliability. My command recently received a directive to "study the feasibility and the implications of revising maintenance procedures by eliminating or drastically reducing the requirement for the maintenance of ground vehicles in a theater of operations." Maintenance has long been a dirty word, but after all it has been my livelihood for about 20 years. Before I planned how I might do myself out of a job, I thought it would be well to develop maintenance criteria and see how the current standard and development type vehicles measured against these criteria. In the course of this work it was felt that we should establish the level of the maintenance effort required in the past, test the level of effort at the present time and develop the tolerable levels of effort to be achieved in the future.

Experience of the First U. S. Army in Europe, from 1 August 1944 to 1 March 1945, with an average of 1,100 medium tanks in combat, showed that 89% of the tanks in the hands of using organizations were operational each day.

In World War II, the Red Ball Express was organized in Western Europe and put into operation on 25 August 1944, continuing for 81 days. During this supply operation the Quartermaster Corps used 83 companies of 40 vehicles each, or a total of over 3,000 vehicles. On the average 73% of the trucks used by Red Ball were operational. Of the 27% that were not operational, a significant number of vehicles were out of operation due to flat tires, out of gasoline and other factors not related to the reliability of the vehicles. To overcome this type of difficulty, which is one of service rather than maintenance, roadside service stations and roving wrecker service were used on the successor black diamond route and resulted in 81% of the vehicles being operational.

During World War II, medium truck engines required rebuilding after 13,000 miles in Africa and 5,000 miles in the mountains of Italy. About 10,000 miles of service was realized from engines on Red Ball, and over 5,000 were worn out and replaced during Red Ball. It was significant that general purpose vehicles in maintenance shops for over 24 hours averaged below 2.5% of the total vehicle population.

Assuming that current standard and development type vehicles should reflect a measure of technological improvement over the vehicles of 1940-45, the maintenance criteria, shown on the chart on this page, are valid: Note that two time-frames are indicated, 1960-63 and 1964-1970. In the first time frame we expect a standard or development type wheeled vehicle to have a 90% probability of going its first 10,000 miles without requiring maintenance more extensive than the replacement and adjustment of minor parts and of accomplishing 20,000 miles before failure of components is experienced. For tracked vehicles the criteria are 2000 miles without requiring maintenance more extensive than that available within the using organi-

	1960-1963	1964-1970
Wheeled Tactical Vehicles	**10,000 mi w/o field maint. 20,000 mi w/o depot maint.**	**25,000 mi w/o field or depot maint.**
	90% prob of achieving	
Tracked Vehicles	**2,000 mi w/o field maint. 4,000 mi w/o depot maint.**	**5,000 mi w/o field or depot maint.**

zation and 4000 miles before components fail.

In the second time frame we expect to have a 90% probability of going all the way without the annoyance of vehicles dead-lined due to mechanical failures.

For all practical purposes we are in the first time frame right now. I am distressed to report that extensive field usage surveys and analysis of engineering tests reveal that the best of our current standard wheeled vehicles has a 42% probability of completing 20,000 miles before requiring rebuild of components, and that tracked vehicles have 3% probability of reaching 4,000 miles without the failure of a major component. Here is a challenge for industry, phrased in terms which I think we all can understand. I hope that the companies responsible for current development projects will hear this challenge loud and clear.

In simple terms I am saying that the components that provide 100,000 miles of trouble-free operation in commercial applications seldom give more than 15,000 miles in the military environment.

The Military Environment

There are many interstate trucking companies and bus lines that measure the life of components and vehicles in hundreds of thousands of miles and to whom breakdown on the road is intolerable. These are the same kind of components, designed by the same engineers, and manufactured by the same companies that develop and produce the components and military wheeled vehicles for the Army. The obvious question is: Why is trouble-free service in commercial practice measured in hundreds of thousands of miles, while service in a military environment is only a fraction of that figure?

Commercial vehicle design and operations have benefited greatly, in the past 30 years, from the vast improvement in roads which this country has enjoyed. In fact the commercial and the military environments have become so widely divergent that the Army must finally realize that the development of satisfactory military vehicles will not come about as a free by-product of normal progress in the commercial automotive industry.

I do not propose that the Army abandon the use of commercial components, because the Army cannot afford to duplicate development costs and to amortize the costs of special tooling over short production runs. Industry should undertake to develop ancillary protective devices to assure that commercially developed components will survive in the military environment. The Army must interpret the military environment to industry and inform them of the maintenance criteria to be met and the nature of engineering tests. Industry must recognize the Army as the expert in matters affecting the military environment. With the establishment of this relationship, we may expect a renaissance in such projects as:

1. Improvement of air-intake systems, crankcase breathers, oil and fuel filters.
2. Development of sealed brakes and the application of retarders.
3. Design of fail-safe and fool proof devices to prevent the destruction of expensive engines and transmissions.
4. Incorporation of check-out and test features in systems and components.
5. Application of pre-lubricated or self-lubricating assemblies, potted or sealed to preclude tampering and developed for long-service-free life before being thrown away.

I am satisfied that 40% of the components which the field usage survey showed as removed for rebuild, were removed prematurely and could have been continued in service for many more miles. We all know that the timid, or poorly qualified inspector will replace a component whenever there is a doubt, rather than squeeze out remaining service life. This is a costly procedure and it can only be countered effectively by providing man-portable, foxhole type of diagnostic equipment capable of analyzing the serviceability of complex equipment without relying on the personal judgment factor. The missile and drone aircraft people are far ahead of us in this matter of check-out equipment, but they work with electronics, hydraulics and pneumatics, while we deal with heavy torque.

What can be done to synthesize the internal functions of a heavy gear train, without removing it from the chassis and connecting it to heavy dynamometers? Can we utilize sound, vibration, temperatures or some other kind of signature to compare an installed component with a standard? We have had many offers to collate the information once it has been developed, but we are still looking for a practical method for developing the synthesis by some means other than torque absorption.

I am convinced that we have required organizational maintenance personnel to fondle their vehicles; in other words they love them to death. In an effort to align organizational maintenance with the owner maintenance attitude that you take towards your personally owned automobile, the scope and time intervals between organizational maintenance services have been adjusted to decrease the maintenance effort by approximately 40%.

The Ordnance Corps has adopted a policy of inspection and repair only as necessary in the rebuild of vehicles. Instead of tearing every vehicle and component to pieces and grinding away metal, we now endeavor to accomplish necessary repairs to components without removal from the chassis. Again savings in service life, time and money are being realized.

I am sure that industry's reaction at this point is a familiar one: "Tell us what you want and give us the money." I think this requires examination:

First, we want the things you produce, because we can't afford special tooling cost. But we want them adequately protected so we get longer service life in the military environment.

Second, we will pay for the development of special protective devices and for special development requirements, where there is no commercial counterpart, but we can hardly be expected to pay for the application of a commercial component unless it will give improved service life in the military environment.

Third, the need for reliability in military vehicles warrants the use of incentive type contracts for the development of military vehicles and components.

Army Missiles and Space Technology

By BRIGADIER GENERAL J. A. BARCLAY

SINCE we have entered an era when the vacuum of space is exerting pressure upon our nation and upon our plans for national security, I can not resist the opportunity to discuss the transition from Army missiles to space technology and some of its implications before the Armor Association. It is certain that at the present cost of $25,000 per pound of payload in orbit we are not going to have M48 tank satellites. I have the feeling that in some quarters we of Ordnance, who are engaged in the development of missile systems and outer space vehicles, are considered as some element pretty far removed from reality. We do not, contrary to rumor, perch loftily on cloud nine and survey the passing scene with complete detachment. I assure you that we are very much a part of the Army and always mindful of our obligations.

The primary mission of the Army Ordnance Missile Command is to develop efficient, reliable and mobile weapons systems which will augment the firepower of the field army, to put them in the hands of troops and to maintain them so long as the systems remain useful. Our activities in space are an extension of that objective, regardless of the newspaper headlines.

Even more to the point, we value the necessarily close working relationship with the Combat Arms—Artillery, Armor and Infantry. When the Army Ballistic Missile Agency was activated February 1, 1956, a truly unique organization came into being. For the first time in Army history we brought together on site and under one command a coordinated team representing the users, the developer and the producer of complex weapons systems. From design through production and deployment, the user has made his influence felt. The first Artillery group armed with the giant Redstone Ballistic Missile system was trained for deployment at Redstone Arsenal in direct contact with the development agency. This also represented another Army "First." We profited greatly from the experience and I am sure that the Artillery likewise profited.

Other Technical Services share in the programs entrusted to the Agency. Each is represented on the Arsenal for the purpose of bringing the specialized knowledge and talents of the Service into play during the process of bringing the weapon from drafting board to launching pad and into the field. The Corps of Engineers, Signal Corps and Transportation Corps, for example, share our daily tasks and have made invaluable contributions to our successes. Briefly this may afford a picture of how we operate. It explains the reason for the creation of the Missile Command—to integrate all the resources of the Army in the challenging and fast moving field of missile development and space programs.

The Command consists of the Headquarters and four major elements: The Army Rocket and Guided Missile Agency; The White Sands Missile Range; Redstone Arsenal and The Army Ballistic Missile Agency. ARGMA, as we call it, is charged with responsibility for development, procurement, production, industrial engineering, industrial mobilization, maintenance and repair parts and stock control of rockets and guided missiles. These include all Army surface-to-surface and surface-to-air missiles except the ballistic missile systems for which ABMA is responsible. The ARGMA systems include the Sergeant, Corporal, Honest John, Little John and Lacrosse in the surface-to-surface category, and the Hawk, Nike, Ajax, Nike Hercules and Nike Zeus in the surface-to-air family.

The ABMA is the first agency to be created exclusively for the performance of Technical Service responsibilities for long-range ballistic missile systems. Redstone and Jupiter are the best known examples of our work. In addition, we have the oncoming Pershing ballistic missile now in development. Our responsibilities cover research and development, fabrication of components, procurement, production, static testing and launching. Space projects are assigned to us by the Advanced Research Projects Agency of the Department of Defense and the National Aeronautics and Space Administration. Collectively the space projects now represent about 45 percent of our total effort in-house.

ABMA has the capability to carry any long-range missile project or space vehicle through the development stage within its own laboratories and shops. We actually have the skilled manpower and facilities and equipment to design, build, test and launch the completed system. Nine laboratories are located at Redstone Arsenal. The tenth is the Missile Firing Laboratory operating our launch facilities at Cape Canaveral, Florida, the site of the Atlantic Missile Range. We employ in the neighborhood of 6,000 personnel, most of them civilian. We are supported by a contractor complex in private industry which reaches into every State with the possible exception of the newest members of the Union.

The Army's interest in rocketry predates the establishment of a directing center for its programs at Redstone. Let us review some of the advantages offered by rocket-propelled systems which explain the emphasis currently placed upon them.

The guided missile is capable of all-weather operation and can deliver a variety of warheads over extended ranges beyond conventional Artillery. Compared in terms of flexibility, mobility and lethality, the manned aircraft and the unmanned carrier or missile are currently competitive. The cannon, once a dominant factor on the battlefield, is constrained by comparison because of its limited range and lesser warhead transportation potential. Tactical type missiles have replaced or are supplementing Artillery in Airborne and Motorized Forces because they minimize the problem of moving heavy artillery equipment. While the missile itself may be larger and more complex than the artillery shell, it has a higher proportion of payoff in warhead than the gun and artillery shell combination and can be moved and emplaced rapidly.

A comparison of a mobile missile launching site with the airplane and its airfield and service complex points up another advantage. There is no large fixed installation which can be concealed. Therefore it becomes an inviting target to the enemy. The high velocity and ballistic trajectory of missiles tip the balance in their favor. Missiles do not require exposure of highly trained crews to defensive fires in flight over hostile terrain. The most invulnerable means to rain destruction upon an enemy, in the present state of military technology, is the guided missile which can be fitted either with nuclear warhead or one containing conventional high explosives.

The guided missile has already influenced military organization and the techniques of the employment of forces in land warfare. As we consider the situation, I want to point out that dynamic technology has made obsolete static and rigid organizational concepts. The same imagination which foresaw how the firepower and mobility of Armor could rule the battlefields of World War II must be used to assure that missiles are integrated into our tactical units so that their full potential can be realized.

Circumstances compel us to be prepared to engage an enemy under altogether unlike situations:

1. Those in which no nuclear weapons will be employed but the threat of their employment is ever present and prevented only by international covenants or fear of retaliation;
2. Those in which nuclear weapons will be unlimited in use;
3. And the circumstance in which nuclear weapons will have limited employment or limited yields. Our weapons, our techniques of employment and deployment must therefore be susceptible to ready modification to meet any conditions.

I believe certain assumptions are justified. Insofar as we can see the organization of missile firepower will be around weapon systems which offer interchangeable warhead capabilities. The enormously powerful and costly long-range missiles with their nuclear warheads are not likely to be employed for fire missions which can be more easily accomplished by their smaller brothers. Tactical fire units equipped with smaller missile systems which can deliver either conventional or nuclear warheads can engage a greater number of different targets in a given period than is possible with the larger weapons. In keeping with the philosophy of measured destruction limited to tactical and strategic targets, a variety of warhead sizes is required to avoid unnecessary destruction or contaminate terrain which is friendly or may be desired for maneuver or occupation.

In a peacetime environment concealment becomes exceedingly difficult. We must rely upon highly mobile task forces and attain proficiency in the art of not being caught with our heads on the chopping block. We expect the deployment of smaller and more dispersed units with less immediate support over larger areas. Each unit will be more self-contained and more capable of independent action although it may require considerable support from more remote locations. All these factors are weighed carefully in arriving at proper weapons design.

The means by which to implement and support our forces must suit the commander's need for rapid and efficient transportation. They will include heavy-lift helicopters, cargo planes requiring little if any advance preparation of landing strips, light and fast-moving land cargo vehicles capable of operating in all types of terrain. The traditionally long and cumbersome logistical tail must be sliced off because it is too vulnerable and relatively inflexible.

Looking farther ahead it is entirely conceivable that the use of the missile as a means of delivering men and matériel to the battle area, or for deep penetrations into hostile territory, will be induced by the vulnerability in combat environment of piloted aircraft and their complex aerodromes.

The concept of missile transport does not appear quite as revolutionary today, in the aftermath of the rapid progress achieved in missilery over recent months. The Chief of Army Field Forces [now CONARC], proposed the use of missiles as transport vehicles in 1948 and this requirement was restated by Department of the Army in 1955. I can tell you the state of the art has reached a point today at which missile transport is technically feasible.

Commanders have repeatedly faced the problem of supplying isolated and beleaguered units—the Army experienced just such situations in World War II in Normandy and at Bastogne, again in Korea. In several instances the enemy and the weather combined to make re-supply and relief impossible or extremely costly in personnel and matériel. In these circumstances the missile transport medium is superior in speed, accuracy, flexibility, mobility, immunity to enemy countermeasures and is independent of weather and terrain obstacles.

Recently a missile contractor demonstrated for the missile command and other interested Army agencies a solid fueled vehicle capable of transporting food, medical supplies or small quantities of ammunition. An extension of the weight-carrying potential by the use of larger systems, such as the Redstone, is entirely logical.

We expect to demonstrate this capability in our contribution to project

Mercury, the manned satellite program of the National Aeronautics and Space Administration. For the Army's part of this national project, we will fire several Redstone and Jupiter missiles from Cape Canaveral. Some of these will test the capsule being developed for NASA which, with a larger thrust unit, will become a man-carrying satellite. Others will transport animals. Some will carry the carefully selected Mercury Astronauts over a distance of about 130 miles. During the flight the pilot will be subjected to high launch acceleration, five minutes of weightlessness and high reentry acceleration. He will attempt to hold the attitude of the capsule and to change its attitude. Out of this program will come convincing proof, I believe, of the feasibility of employing missiles to transport men in emergency battlefield situations.

The Redstone was selected for initial experiments by NASA because of its high reliability factor, the aerodynamic stability provided by its rudder vanes and, in the words of Charles W. Mathews of NASA's Space Task Group, "It is the missile that has had the most experience behind it." Two Jupiter IRBM's are also scheduled in the Mercury program to qualify the final capsule design. The Jupiter firings will probably take place over a range of about 1,200 miles. Having successfully recovered two Jupiter nose cones in undamaged condition in May and July, 1958, we are optimistic about the results of the forthcoming shoots.

Mercury is, of course, the most spectacular of our current space projects, and from the standpoint of missile transportation, perhaps the most significant to the Army's future. Behind our contribution to this project is a wealth of experience represented by the development team headed by Dr. Wernher Von Braun. Few people realize that this same team was exploring the fringes of outer space nearly 15 years ago at White Sands. Utilizing the V-2 and other rockets, they built up a wealth of data concerning instrumentation and other aspects of space exploration that paid off a huge dividend with the successful launching of the Explorer, first of the free world's earth satellites, on January 31st, 1958. Since then we have orbited two more Explorers using the Jupiter C multistage rocket system developed for the primary purpose of solving the reentry heat problem for the Jupiter IRBM. I cite this as an example of the contributions military rocket systems have made, and will continue to make, in the investigation of spatial phenomena.

The Explorers were the means by which the existence of the Van Allen radiation belt was discovered—that high energy band of radioactivity which hovers above the earth. Explorer IV was the instrument which detected and measured the artificially created radiation in project Argus. In December, 1958, utilizing the Juno II configuration based upon the Jupiter system, we fired the first of two deep space probes under NASA sponsorship. On March 3 we launched the second, Pioneer IV, which sped by the moon after achieving escape velocity and became the first made-in-the-USA satellite of the sun. Pioneer IV continued to transmit data back to earth stations over a distance of more than 400,000 miles. No other man-made object has equalled that record. It demonstrated that we can track and communicate with space vehicles at distances far beyond the moon.

Practically all the space projects undertaken to date in the national program have been based upon existing rocket systems derived from the military services. While this exploited the availability of hardware, it also means that the parameters of performance were definitely established and limited to techniques needed to put a warhead on target at ranges of 1,500 or 5,000 miles.

The largest rocket engine available to the Army is the type utilized in Jupiter and it produces about 150,000 pounds thrust. In order to put substantially larger payloads into orbit, or to hurl heavier payloads far into space, much greater initial thrust is needed. We are now attacking the problem for ARPA in the development of project Saturn. This will employ Jupiter type liquid propellant engines in a cluster which will produce thrust in the order of 1,200,000 pounds. I might note this is considerably larger than anything our competitors behind the Iron Curtain have demonstrated to date.

I can not go into detail about Saturn. I can tell you this much—it will make possible worldwide communications relayed by satellites which will benefit the Strategic Air Command, the Navy's Fleets and the Army's Tactical Forces. Since the line-of-sight range of a satellite at relatively high altitudes is much greater than anything which can be supplied by earthbound relay stations, the possibilities of instantaneous transmission and reception of audio and visual signals are tremendous.

The Army has legitimate interest in other applications of space technology. For example, a weather observation satellite could be of enormous benefit since adverse weather directly influences tactical operations. So, too, with reconnaissance over wide areas. A suitably instrumented orbital vehicle, positioned at the correct altitude, could afford reconnaissance coverage of every point on earth daily. Under that kind of surveillance, large-scale preparations for hostilities could not enjoy the advantage of secrecy.

The anticipated rapidity with which targets will appear and disappear in event of future warfare emphasizes the requirement for surveillance and target acquisition techniques. The commander must have reliable, prompt information about any meteorological conditions that could affect the accuracy and effectiveness of his striking power. Well-organized detection and communication systems must link the agencies of Intelligence, Command and Execution. Drones are one limited solution, satellite applications have greater potential.

In summary, I would emphasize that guided missiles have applications in both the tactical and strategic roles. They are extremely useful additions to our arsenal but they are by no means ultimate weapons. Over the years they may be expected to supplement and replace manned aircraft in military employment related to battlefield environment. They will bring other unforeseen changes in our weapons systems concepts.

We may be certain that man can find means of adapting himself to the hostile vacuum of space and that he will develop new ways of using this environment to expand his social and economic life. He will use this new environment also as a maneuver area for new weapons based on mobility and firepower to preserve his security on earth.

The New Council

President

LIEUTENANT GENERAL GEORGE W. READ, JR.

Honorary President

Major General Guy V. Henry, Ret.

Vice Presidents

Major General W. Paul Johnson
Major General Donald W. McGowan, NG
Colonel Willard Webb, USAR

Honorary Vice Presidents

General Jacob L. Devers, Ret.
General Williston B. Palmer
General Willard G. Wyman, Ret.
Lieutenant General Edward H. Brooks, Ret.
Lieutenant General Clovis E. Byers, Ret.
Lieutenant General John H. Collier, Ret.
Lieutenant General Willis D. Crittenberger, Ret.
Lieutenant General Hobart R. Gay, Ret.
Lieutenant General Alvan C. Gillem, Jr., Ret.
Lieutenant General Geoffrey Keyes, Ret.
Major General Ernest N. Harmon, Ret.
Major General John C. Macdonald, Ret.
Brigadier General Sidney R. Hinds, Ret.
Brigadier General Willard A. Holbrook, Ret.
Brigadier General Henry Cabot Lodge, USAR
Brigadier General Paul M. Robinett, Ret.
Brigadier General Harry H. Semmes, Ret.

Secretary-Treasurer

Lieutenant Colonel William H. Zierdt, Jr.

Executive Council

General Bruce C. Clarke
Lieutenant General Thomas L. Harrold
Lieutenant General Arthur Trudeau
Major General Frederic W. Brown
Major General Homer O. Eaton, NG
Major General Robert E. Frankland, NG
Major General Louis V. Hightower
Major General Clayton P. Kerr, NG
Major General Harry W. Johnson
Major General Samuel L. Myers
Major General Almerin C. O'Hara, NG
Major General James B. Quill
Major General Maxwell C. Snyder, NG
Major General John K. Waters
Major General Earle G. Wheeler
Major General Edward O. Wolf, NG
Brigadier General Charles G. Dodge
Brigadier General James I. King
Brigadier General Hal C. Pattison
Brigadier General Frank Henry
Brigadier General W. H. S. Wright
Colonel Boyd Branson
Colonel Lawrence V. Greene
Colonel Delk Oden

. . . salutes from around the world

. . . Modern atomic weapons have increased the importance of Armor in the ground operations of major wars, while its decisive role in limited wars has been demonstrated again and again.

The U. S. Armor Association takes a leading part in bringing forward new ideas, new developments, and fresh battlefield leadership. It deserves our best support. May its future be ever more distinguished and valuable to the Army.

W. B. PALMER
General, United States Army
Deputy Commander-in-Chief, EUCOM

. . . Upon the occasion of the 70th Annual Meeting of the United States Armor Association I wish to extend greetings and best wishes to all members of the Association from the officers and men of the United States Army, Pacific.

In the 182 years since Cavalry was established as a major combat arm, it has consistently been a vital element of the military strength of the U. S. Army. Transformed into Armor in World War II and provided with new and then radical types of equipment, the Mobile Arm of Decision rose to magnificent heights and revolutionized ground warfare.

The demands of today are no less exacting. Today armies of the world and all combat arms within those armies seek to develop their firepower, mobility and shock action to unprecedented degrees under the pressures of dramatic technological advances. These characteristics which have long typified Armor are no longer exclusive to one branch or one Army. As the foremost proponent of mobile warfare in the past, it is Armor's duty today to lead the way in developing the future. I know of no military group more qualified to resolve the ground combat problems before us than the members of the United States Armor Association. Your reaction to the challenge may well define not only the future of Armor but, more importantly, the entire U. S. Army. Through your efforts as members of the combined arms team, the state of combat readiness of our Army can be improved and the Army's prestige as a major element of American military power can be enhanced.

I. D. WHITE
General, United States Army
Commander-in-Chief, USARPAC

. . . The officers at The National War College join me in extending greetings to the membership of the United States Armor Association on the occasion of its 70th Annual Meeting.

There is no membership more qualified than you to resolve the complex and detailed problems of Armor development and Armor employment which keep Armor abreast of the concepts of war.

THOMAS L. HARROLD
Lt. General, USA
Commandant

. . . My experience as Chief Controller of the last two large Seventh Army Winter Maneuvers has confirmed me in my belief that Armor is the ground combat arm best suited to the atomic battlefield.

"The soul of Armor is elan, aggressiveness, the will to fight, reckless but ordered discipline. The spirit of Armor is the spirit basic to any Army, a spirit not exclusive to this arm alone, but one of which it is peculiarly possessed."

GORDON B. ROGERS
Lt. General, USA
Commanding General, VII Corps

. . . To meet the challenges of the future our Army must be capable of participating successfully in any type of war, on any terrain, ranging from sustained operations with major forces to smaller scale actions in remote areas. Nuclear warfare, whether general or limited, sets a premium on mobility, firepower, and protection against atomic effects. The tank is the weapon of ground warfare which best combines these characteristics.

Today, the combined action of mobile armored forces holds the greatest promise for success in battle. Nevertheless, if we are to insure such success in the future, we require a substantial enhancement of our capabilities in such areas as mobility, reaction time, protection—both radiological and ballistic—operating range, surveillance and control.

All of us who are working in Army Research and Development are dedicated to the purpose of providing the Army with the best possible equipment in the shortest possible time to solve these requirements. This is not a job that we can do alone. It requires the cooperative effort of all who have a stake in the Army's future. The Technical Services, the various test agencies, the combat developments organizations, the schools and the units and individuals in the field, must all feel a sense of urgency to contribute to this effort. We need a bold approach to a light, powerful tank that is rugged and simple. We cannot afford to prolong the development cycle by a vain pursuit of absolute perfection in our equipment. This course is costly in both time and money. Reasonable performance criteria should, of course, be established and met, but beyond this point we should devote our efforts and resources to achieving truly significant advances in firepower and mobility and a decrease in overall weight.

On the occasion of its 70th Annual Meeting, I believe the Armor Association should know that the Army has recently initiated development projects which promise to give Armor the really significant advances that it seeks. You can be certain, for instance, that the main battle tank of the future is going to be considerably lighter in weight than the M48 Series and M60 and at the same time possess a much greater lethality. We expect also to provide an armored fighting vehicle to perform the light tank mission which will have a lethality comparable to that of the future main battle tank but, at the same time, incorporate air-transportable and amphibious characteristics.

I am sure you all understand that the development

of new hardware is made possible only through fresh ideas. Research is an absolutely fundamental requirement if we are to provide the equipment that will make our Army the most modern in the world. We are conducting an active research program designed to increase our basic knowledge and provide us with the technology to apply this knowledge in solving our problems. However, we are always anxious to broaden the base from which we gain new ideas. It is my earnest wish that the members of the Armor Association would address themselves, both individually and collectively, to the matériel requirements for a modern Army, and offer their best thoughts to achieving our common goal. You will find that your contributions will fall on receptive ears.

ARTHUR G. TRUDEAU
Lt. General, USA
Chief, Research and Development

. . . My 19 months' experience as commander of III Corps —which included service as deputy director for three large-scale training exercises and as commander of the U. S. player force in another—reinforced my conviction that Armor is particularly well suited for employment on the modern battlefield. Powerful, mobile, flexible and versatile, it is truly the Arm of Decision.

WILLIAM S. BIDDLE
Major General, USA

. . . Greetings to the membership. Sincere good wishes for a most successful meeting. The members here on Taiwan will be with you in spirit and looking forward to the report in *ARMOR*.

L. L. DOAN
Major General, USA
Chief, MAAG, Taiwan

. . . As a recent Commander of an Armored Division in Europe, I can assure you that our officers and men are displaying all the spirit and ability which have made Armor great in the past. There is no question in my mind that on the atomic battlefield the mobility and protection of Armor must be vigorously applied to exploit the effects of our atomic shots. I believe that the responsibilities of Armor and the Armor Association are greater today than they have ever been in the past.

ANDREW P. O'MEARA
Major General, USA
Headquarters EUCOM

. . . I am proud to extend greetings and congratulations on behalf of the officers and men of the 4th Armored Division to the members of the U. S. Armor Association as you assemble for the 70th Annual Meeting.

I am happy to pass on the report that the Division decisively demonstrated, in the recent Seventh U. S. Army maneuver, "FREE PLAY," a very high order of combat-readiness. The new personnel we are presently receiving from the 2d Armored Division are being rapidly and smoothly integrated into our team, and I feel sure that upcoming training exercises and tests will show that our present capability of complete and instantaneous combat-readiness remains at its peak. Finally, intensive studies of organization, tactics, procedures, and matériel are being continuously directed toward the advancement of this all important capability.

In these efforts we look to the U. S. Armor Association, in its deliberations as well as its publications, for helpful guidance and for continuation of its fine support.

JAMES B. QUILL
Major General, USA
Commanding

. . . The Officers and men of the "Spearhead" Division join me in wishing the Armor Association a pleasant and successful 70th Annual Meeting.

We in Europe realize that Armor is truly the combat arm of decision of the United States Army, as it alone has the armor protection, mobility and firepower required to survive and defeat a numerically superior enemy on the nuclear battlefield.

THOMAS F. VAN NATTA
Major General, USA
Commanding

. . . Cordial greetings to all members and guests of the Armor Association from the 2d Armored Cavalry Regiment.

The progress and continued development of Armor is not only of considerable interest to us, but of vital importance to the operations of this Regiment which is presently deployed so as to absorb the initial shock of Soviet aggression.

RICHARD G. CICCOLELLA
Colonel, Commanding

. . . On behalf of the members of the 4th Armor Group, I extend to the members of the U. S. Armor Association our best wishes for a profitable meeting.

We, who serve in Armor, are proud of the role we play in the National Defense and recognize the outstanding contribution made by the Association in this regard.

ROBERT W. KANE
Colonel, Commanding

. . . The officers and men of the 11th Armored Cavalry Regiment join me in extending to all members of the Association our sincere wishes for a profitable meeting.

JAMES W. SNEE
Colonel, Commanding

. . . I extend my personal greetings and those of the officers and men of the 14th Armored Cavalry Regiment.

Our border mission here in Germany prevents actual attendance at this year's meeting. However, we will follow your activities, discussion and decisions with great interest and know that the 70th Meeting will contribute immeasurably toward the defense of our country.

WILLIAM E. POTTS
Colonel, Commanding

This article covers the

Objectives for Armor of the Future

and reports the progress being made toward attaining those objectives.

By GENERAL BRUCE C. CLARKE

I AM pleased to have this opportunity to address the Washington Chapter of the Armor Association. Informal gatherings of this nature serve a useful purpose in keeping us up-to-date on the latest developments. Consequently, on this occasion, I would like to review the objectives for Armor as I see them and to relate the progress we are making toward attaining those objectives. I will cover matériel, organization and training.

In discussing Armor, we must consider it as a member of the combined arms team. I am convinced that Armor will play a vital role on the future battlefield—as a member of that team. If I ever doubted the potential of Armor such doubts were erased when, as Commander of Seventh Army, I assessed the capabilities of the 70,000 tanks just across the Iron Curtain.

Victory on the future battlefield will demand:

1. Superior firepower
2. A high degree of mobility
3. Flexibility in organization and operations
4. Rapid responsiveness to command, and
5. Sustained combat effectiveness

These are attributes long advocated by those in Armor. All elements of the Army are now striving to attain these characteristics. The Army is slowly approaching a branchless organization. We are a "combat team" Army. We must think and operate in terms of the combined arms team.

Our purpose is to make Armor a more effective member of that team.

Our field service regulations require that objectives for military operations be decisive and obtainable and that they be related to the means available, the enemy and the area of operations. These principles parallel our objectives in the development of Armor of the future.

First, our objectives must consider the means available. They must be practical and obtainable, be they objectives for matériel, organization or training. They must consider the funds and people we can reasonably expect to get. They must consider the current state of technology, production capacity, training capability, potential for rapid deployment and logistical support.

Second, our objectives must consider the enemy. I am sure that his capabilities need no amplification to this audience. In everything we do—development, organization, training and operation—our objective must be applied against the criterion: Does it increase our capability to defeat our potential enemy?

Third, our objectives must consider the area of operations. We must consider a wide range of possible areas of employment for Armor. We must base our objectives primarily, however, on employment in those areas vital to our national objectives. We must consider the area where the enemy can employ his forces most effectively against us and our allies. I consider Western Europe the most vital area in general war. I consider the Middle and Far East as likely areas in a limited war.

We must then define armor objectives in matériel, organization and training in the light of these considerations and determine what progress has been made toward these goals.

GENERAL BRUCE C. CLARKE, Commanding General, USCONARC, addressed the Armored officers in the Washington, D. C. area on the 22d of May. Due to the significance of his remarks we obtained permission to publish this excellent speech for the benefit of the entire Association membership.

In the matériel field we want equipment that is effective, simple, reliable, rugged and easy to maintain.

Our first matériel objective is an improved main battle tank to replace our current medium and heavy tanks. It must have a simple, accurate weapons system capable of defeating any known enemy armor. Further, it must have the greatest practical operational range—at least 200 miles without refueling. Its other characteristics should be at least equal to our current medium tank.

The M60 tank with its 105mm gun and its diesel engine approaches this objective. It will be in production shortly. The M48A2 with its improved 90mm ammunition and its fuel injection engine is a good "runner-up."

We cannot be satisfied, however, with current equipment. We must constantly improve. We have under development a new weapons system with greatly improved accuracy and lethality and increased simplicity of operation. Also under study are multi-fuel engines, exotic fuels and means of applying nuclear fuel to tanks.

In addition, an armored reconnaissance/airborne assault vehicle is under development to replace the light gun tank and M56 assault gun. This vehicle must have equivalent firepower to the main battle tank. To achieve amphibious and air-transportability capabilities in this vehicle we will accept reduced armor protection.

A second matériel objective is to increase mobility and decrease the number of vehicles in the "logistical tail." In this area a family of vehicles called GOERS, based on commercial earthmoving equipment, offers great promise. These vehicles can traverse ground impassable to standard military trucks. In addition, each vehicle can carry a payload of eight to 16 tons—replacing three to six other cargo trucks. Military prototypes are now being produced.

Progress is also being made in bulk refueling equipment and means of air resupply.

A third matériel objective is improved antitank protection throughout the Army. This is important to Armor since otherwise tanks might be tied down to antitank defense—instead of being employed offensively where they are most effective. We are developing powerful rocket and recoilless systems to replace the 3.5" rocket launcher and the 106mm recoilless rifle. We are equipping certain Infantry and airborne units with the French SS10 as an interim antitank guided missile.

Our fourth matériel objective is to provide surveillance devices for rapid, accurate target acquisition and protection against infiltration. We cannot afford to fire expensive missiles at suspected targets. We must have the means to determine quickly and pinpoint accurately profitable enemy targets. We have recently added ground and airborne radar to Armor units. We are increasing the number of light aircraft and adding drone aircraft to the armored division and the armored cavalry regiment. Several other new devices are under development which will greatly increase Armor's capability for reconnaissance and surveillance.

These are our more important matériel developments. In addition, we finally have an acceptable tanker's helmet. Further development is being accomplished to reduce its size and cost. Combat crewman's clothing is also being developed.

The M113, a lighter, faster and generally improved armored personnel carrier, is under procurement and will replace the M59. Also under development is the T114—a tracked, armored vehicle which will replace the jeep for reconnaissance purposes. This vehicle will also serve as a recoilless rifle carrier.

In the organizational field our objective is to provide units with improved mobility, greater flexibility, increased firepower and sustained combat effectiveness. The future battlefield environment dictates that organizations be capable of forming effective semi-independent combined arms teams. These teams must be logistically self-sufficient to the degree required for such operations.

Field test of the current armored division indicated it was well suited to carry out its missions under conditions of non-nuclear warfare. It is believed equally suitable for nuclear

(U. S. Army)

The M60 Tank.

(U. S. Army)

The M113 Armored Personnel Carrier.

warfare. Minor changes only are being made in its structure. These changes are designed to improve:

1. Command control
2. Fire support coordination
3. Assault bridging capabilities
4. Reconnaissance and surveillance, and
5. Supply and maintenance capabilities

There is no change in the basic divisional structure. Active Army and National Guard divisions are being reorganized under this revised structure.

Studies of a possible pentagonal armored division structure are also being made. The combat group of this type division is to be tested in FY 60 and the division may be tested in FY 61. Whether the pentagonal structure provides sufficient advantages over our current organization to warrant adoption remains to be seen. Several other new divisional organizations—some of a rather radical nature are under study by my Headquarters and combat development agencies. I consider, however, that we currently have a fine armored division organization and will give the whole matter careful consideration before recommending any major changes.

With respect to the armored cavalry regiment, concepts of future employment dictate that we increase its aerial reconnaissance and surveillance capabilities and the potential of its squadrons for semi-independent operation. A revised organization is under preparation which deletes the regimental service company and places in the squadrons the supply and maintenance elements required for semi-independent operations. An aviation troop has been added to the regiment. This troop includes an aerial surveillance platoon.

To further increase the mobility of Armor we are developing concepts for organization and employment of aerial reconnaissance and security units. These units with their armed reconnaissance and troop carrying helicopters will facilitate Armor operations in difficult terrain.

With the greater dispersion of task forces on the future battlefield, I foresee a requirement for an even greater use of reconnaissance and surveillance units than in the past.

In general, I believe our armor units have attained a high degree of flexibility and sustained combat effectiveness in their organization. We shall continue to strive towards improving their mobility and increasing their firepower.

With regard to training, I consider that we have two major objectives: namely, to improve training generally and to decrease readiness training time.

Training improvement is one of the principal missions of USCONARC. We must do everything we can to increase training effectiveness. We must go about our training task with an urgency commensurate with the present world situation. Examples of the measures being taken are:

1. Concentration on the fundamentals of teaching the soldier to *move*, to *shoot*, to *communicate* and to *maintain* himself and his equipment.
2. Stress on the use of noncommissioned officer academies. Such academies increase professional qualifications, instill confidence and improve unit standards.
3. Provision of better qualified instructors at our replacement training centers.
4. Constant review of training literature and programs. The Armor Advanced Individual Training Program has recently been revised to produce a qualified tank driver and gunner. A complete set of new Armor field manuals has been published except for the Armored Cavalry Manual. That organization is now firm and this manual will be published shortly.
5. A revised tank gunnery qualification course is under test which emphasizes crew training and includes night firing.
6. Our motto is "An organization does well only those things the boss checks."

The second major objective in the training field is to decrease readiness training time. No longer do wide oceans and powerful allies protect us from our enemies and give us time for leisurely preparation after hostilities begin. D-Day could come tomorrow and require an immediate build-up of our forces overseas, both in units and in trained individuals.

To provide for this contingency we must have the highest possible degree of combat readiness in our forces. Our STRAC units are ready to go. Our STRAF units have made detailed plans to conduct short intensified combat training programs. We have established the same training standards for our National Guard and Reserves as we have for the Active Army.

Combat knows no distinction between components of the Army. There is no difference whatsoever between combat-ready units or individuals of the Active Army, the National Guard and the Army Reserve. To achieve combat-readiness, the same training and the same principles for guiding training must be applied to all. Our objective is *One Army—Combat Ready*.

We are examining our service school program to eliminate courses which have outlived their usefulness and to delete non-essentials from other courses.

Unit training programs are constantly reviewed to eliminate non-essentials and reduce readiness time. We hope to cut, materially, the time required for units to complete mobilization training programs.

In short, we are making *progress* towards producing better trained soldiers and units in a shorter time.

Finally, improvements in equipment, organization and training lay the essential groundwork for effectiveness in combat.

However, we must all be alert, flexible and progressive in our thinking to employ effectively these improvements on the future battlefield.

In this respect we can take a lesson from history. Germany did not possess any marked degree of superiority in weaponry or number of tanks when she etched Europe with blitzkrieg. But she did possess superiority in the way they were employed. She excelled in integrating air and ground weapons in operation. To achieve ascendancy over our massive enemies, we too must integrate improved weapons and organization to achieve greater striking power. It is incumbent on all of us to continue to devise the techniques of employing better the weapons and equipment which military technology is placing—and will place—in our hands.

Plainly the challenge is great!

Tank Commander Training in the Reserve Components

(U. S. Army)

By DR. ROBERT A. BAKER

IN the event of any general war, the Armor units of both the National Guard and the U. S. Army Reserve will be expected to play a key role. For this reason, considerable effort is being made to reduce the training time required for such units to achieve a satisfactory state of combat readiness.

According to many experienced Armor personnel, the most efficient way to reach the goal is to provide for a large number of highly skilled and well-trained reserve officers and NCOs capable of properly leading and instructing the conscripted or volunteered civilians in the essential Armor skills.

Nevertheless, in spite of this effort, a critical shortage of experienced and well-trained tank commanders currently exists in the Armor units of both the National Guard and the Army Reserve. A recent survey of all tank units in the reserve organizations of the six Army areas revealed that only one-fifth of the enlisted tank commanders had completed a tour of active duty with Armor. Moreover, the number of well-trained tank commanders available in the event of an emergency is presently so scant that less than half of the tanks in a full-strength reserve unit would be properly manned (*See: Who Will Command Our Tanks—ARMOR*, May-June 1957).

Some of the background factors responsible for this situation should be noted.

1. Shortly after World War II many non-Armor reserve units were converted to Armor.

2. The reserve noncommissioned officer is seldom able to obtain sufficient leave time from his job to permit him to attend any lengthy period of instruction at The U. S. Army Armor School.

3. At present there is no unified NCO correspondence program specifically designed to train reserve personnel in the essential tank commander skills.

Recognizing these facts, personnel of Company B, 813th Tank Battalion, 79th Infantry Division, USAR, in Philadelphia, Pennsylvania, visited Fort Knox in June 1957, and requested assistance in the preparation and administration of a special program of instruction designed to better prepare their senior NCOs for the tank commander's duties and skills. In discussing this request with members of the U. S. Army Armor Human Research Unit (USAAHRU), a joint CONARC and HumRRO organization, it was decided that such a program was not only desirable but was worthy of an experimental tryout. Company

DR. ROBERT A. BAKER, a former contributor to *ARMOR*, received his BS and MS degrees from the University of Kentucky and his Doctorate from Stanford University. During World War II he served in Europe with the U. S. Army Air Corps. Subsequently he was a research scientist at Lincoln Laboratory, MIT. He is now a senior scientist at the U. S. Army Armor Human Research Unit, Fort Knox. Since 1954 he has been conducting research on armor training.

B personnel, specifically Master Sergeant Robert A. Kandler and Master Sergeant Roland E. Traynor, requested and obtained permission, through channels, to utilize a total of 48 two-hour drill periods for this specific purpose.

Research personnel of USAAHRU then prepared an experimental tank commander's training program, keeping the following objectives in mind:

1. Such a program must be designed so that it will fit the support and facilities available to the reserve organizations.
2. The number of hours of scheduled instruction must not exceed the total currently provided by the Tank Company ATP 17-201.
3. It should cover all of the essential requirements of the tank commander's job.
4. It must be capable of being administered by reserve Armor units having a minimum amount of time, space, training areas, training aids and other supporting matériel.

In line with the requirement that the number of qualified instructors must be kept to a minimum, it was decided that all of the tank commanders participating in the experiment would serve in the role of instructors. Since ten NCOs were selected to participate in this program, each man was made responsible for studying, reviewing and instructing the remainder of the class in certain specified subjects. An outline of the experimental program is shown in Table 1.

Attention should be called to several of the more positive features of this program.

1. Only the most essential tank commander skills are covered, and emphasis is placed on the practical "how-to-do-it" aspects of the tank commander's job.
2. All of the subject matter can be presented either in the classroom or in the tank storage area with the facilities normally available to most National Guard or Army Reserve units.
3. All of the essential study references are currently available either through the normal supply channels or from the Nonresident Instruction Department of The U. S. Army Armor School.
4. It maximizes the advantages of the "each one teach one" philosophy by utilizing the trainee tank commanders themselves as instructors; thus, no additional instructors nor any increase in the instructional load of the present staff is required.
5. The program is arranged so that the fundamentals of instruction and the principles and techniques of leadership—including training in how to instruct—occur before any of the more technical Armor subjects and skills; thus, the effectiveness of the instruction presented is maximized.
6. The program places the Automotive and Weaponry subjects last, in order that these skills will be fresh in mind and that maximum benefit can be derived from the two-week active duty period at a major training area.

Prior to the administration of the program, each of the ten NCOs participating was tested on the *Armor Proficiency Test.** This test a four-choice, paper and pencil test consisting of 198 items, covers all of the essential Armor skills. Each item of the test was either selected from tests currently in use at the School or was prepared by the research personnel after an intensive study of current Armor literature. Over the past five years, this test has been administered to more than 1,500 qualified TOE tank commanders in both active and reserve Armor units, and has been carefully checked to ensure that scores on this test agree closely with on-the-job performance. Company B initiated the program in August, 1957, and completed it at the end of the training year—June, 1958. During this month, when the ten tank commanders visited Fort Knox for the two-week active training period and were retested on the APT, the retest results clearly showed that the program had been effective. A comparison of the test-retest scores revealed an improvement averaging 15 points per man. An inspection of the scores made before the program began placed the average NCO at a score level below that of the average TOE tank commander. The post-test results, however, showed that the ten NCOs now stood at a score level equivalent to that of the typical tank commander in the active Army units.

Other than the obvious improvement in knowledge and skill, some additional benefits of the experimental program were noted:

1. A significant increase in company morale.
2. A significant improvement in the quality of instruction presented was noted by the training inspectors during their summer encampment.
3. An improvement in the ability of the NCOs to lead and command.
4. An overall betterment in the general efficiency of the company.

Due to the success of the initial tryout, personnel of Company B of the 813th Tank Battalion are repeating the program with additional NCO personnel. Moreover, personnel of Company A, 813th Tank Battalion, located in Allentown, Pennsylvania, have also initiated this program.

While it is sincerely believed that the content of the experimental program is of value to all reserve Armor units faced with a similar problem, it should be stressed that the program given in Table 1 is principally a *Guide*. It is believed that this program is flexible enough to be successfully adapted to meet the local needs and demands peculiar to any given Armor unit. The author will be most happy to supply the additional study references, as well as other information and details, to all interested reserve organizations. In conclusion, it should be emphasized that the program outlined above is most suitable for Armor units desiring to conduct separate NCO schools or classes. If separation of the NCOs for specific classes during regularly scheduled drill periods would seriously hamper the training effort, adoption of the program should be delayed or additional arrangements made to meet the unit's training requirements.

* *The Development of Tests for Two Levels of Armor Proficiency*, Staff Memorandum, U. S. Army Armor Human Research Unit, Fort Knox, Sept. 1956.

TABLE 1

TANK COMMANDER TRAINING PROGRAM: RESERVE COMPONENTS

I. GENERAL SUBJECTS ..... 16 Hrs.

1. Fundamentals of Military Instruction; Planning the Lesson; and Presenting Oral Instruction—2 Hrs.
FM 21-6, Para. 13-45; TF 21-2301, -2302, -2303, -2304, & -2306.

2. Training Aids and Their Use, the Demonstration Method and Practical Work—2 Hrs.
FM 21-6, Para. 65-78; TF 21-2305.

3. Basic Map Reading, Signs and Symbols, etc.—2 Hrs.
FM 21-26, Chap. 1 & 2.

4. Map Measurements—2 Hrs.
FM 21-26, Chap. 3.

5. Concepts and Principles of Military Leadership, Combat Leadership and Troop Leading Procedures—4 Hrs.
FM 22-10, Para. 1-16; FM 22-100, Para. 1-26.

6. Duties and Responsibilities of the Tank Crew Members, Crew Compositions and Formations, Crew Control, Crew Drill, Evacuation of Casualties, Mounted and Dismounted Action—2 Hrs.
HumRRO Tech. Report 47, Ft. Knox, Ky., May 58; FM 17-79, Chap. 3; TF 17-1968 & 1969.

7. Effect of Atomic Explosions and Protective Measures in Atomic Warfare—2 Hrs.
DA Pamphlet 21-112, Para. 1-24; TF 17-2504; TF 20-2135.

II. COMMAND AND STAFF ..... 28 Hrs.

1. History and Role of Armor, Armor in Atomic Age, Aggressor Equipment and Employment—2 Hrs.
FM 17-1, Para. 3-18; DA Pamphlets 30-50-1, 30-50-2, 30-40, 30-75; TF 17-1767.

2. Introduction to Combat Intelligence, Collection Plans and Procedures—2 Hrs.
FM 30-7, Para. 1-26, 37, 39, 41 & 42; AR 380-5, Para. 1-120; FM 21-75, Para. 60-67, Para. 76, & Para, 124-139.

3. Organization of the Tank and Armored Infantry Platoon and Organization of the Tank Company—2 Hrs.
FM 17-20, Para. 6-22; FM 17-33, Para. 8-22, 29-35.

4. Conduct of Marches—2 Hrs.
FM 17-1, Para. 197-222.

5. Methods of Attack—2 Hrs.
FM 17-1, Para. 235-289; FM 17-79, Para. 94-102.

6. Action of Individual Tank within the Tank Platoon—2 Hrs.
FM 17-1, Para. 215-234; FM 17-33, Para. 22, 90, 96-100; TF 17-1990.

7. Tank Platoon Combat Formations and Methods of Advance —2 Hrs.
FM 17-33, Para. 43-49; FM 17-20, Para. 38-42.

8. Tank Platoon in the Attack—4 Hrs.
FM 17-33, Para. 50-65, 75-109; FM 17-20, Para. 43-48, 84-86.

9. Armored Infantry Platoon Reinforcing a Tank Company in the Attack—2 Hrs.
FM 17-20, Para. 87-136; FM 17-1, Para. 239-289.

10. Individual Tank in Defensive Operations—2 Hrs.
FM 17-1, Para. 346-411; FM 17-33, Para. 110-142.

11. Individual Tank in Retrograde Operations—2 Hrs.
FM 17-33, Para. 143-160; FM 17-1, Para. 412-438.

12. Armor Team, Armored Division—2 Hrs.
FM 17-20, Para. 31-37; FM 17-33, Para. 8-22, 29-35; FM 17-1, Para. 286-289, 439-441.

13. Night Operations—2 Hrs.
FM 17-1, Para. 310-318; FM 17-33, Para. 109, 142, & 160; FM 17-20, Para. 126-135.

III. COMMUNICATIONS ..... 12 Hrs.

1. Introduction to Radio-Telephone Procedure—2 Hrs.
Communications for Armor, USAAS, 1957-58, Para. 1-14; FM 17-70, Para. 2, 3, 22, 26-28, 32-34.

2. RT Procedure—Prowords and Phrases and Authentication Procedures—2 Hrs.
Communications for Armor, USAAS, 1957-58, Para. 14-26; SSI 301st AD, USAAS, Jan. 1958.

3. Practical Exercises, RT Procedure and Communications Security—2 Hrs.
FM 17-70, Para. 5-11; SSI 301st AD, USAAS, Jan. 1958.

4. Standard Radio Sets: Set #1 and Set #2—2 Hrs.
Communications for Armor, USAAS, 1957-58, Section IV; TM 11-284, Para. 1-22; TF 11-2298.

5. Interphone System and Practical Exercises with Set #1, Set #3, and Interphone—2 Hrs.
TM 11-284, Para. 16, 21, 49, 54; Communications for Armor, USAAS, 1957-58, Section IV.

6. Alternate Means of Communication, and Maintenance and Inspection of Communications Equipment—2 Hrs.
FM 21-60, Para. 3-7, 24-26; Communications for Armor, USAAS, 1957-58, Section VIII.

IV. AUTOMOTIVE ..... 12 Hrs.

1. Army Maintenance System and Maintenance Forms and Publications—2 Hrs.
TM 9-2810, Chap. 1 & 2.

2. Driving and Driving Principles—2 Hrs.
Special Text 17-160, Part IV, USAAS; TM 21-306, Sections I-III; TF 17-2262.

3. Proper Driving Practices—2 Hrs.
TM 21-306, Sections IV-X; FM 17-33, Chap. 2, Para. 29-49; TF 17-2263.

4. First Echelon Maintenance Services—4 Hrs.
TM 9-7102, Para. 74-80, 127-132; TF 9-1805.

5. Weekly Maintenance Services, Inspections, and Supply Procedures—2 Hrs.
Special Text 17-160, Parts V, VI & VII, USAAS, 1955; TM 9-7102, Chap 2; TM 9-2810, Chap. 4.

V. WEAPONS ..... 28 Hrs.

1. Familiarization with M41, M47 and M48 Tanks—2 Hrs.
FM 17-79, Sections I-V; FM 17-80, Sections I-VI; TM 9-718A, Para. 3-91.

2. Tank Gun Ammunition: Identification, Handling, Care and Stowage—2 Hrs.
FM 17-12, Chap. 3; TM 9-1901, Para. 118-128, 142-156.

3. Inspection and Maintenance of Tank Gun, Turret Controls and Equipment—2 Hrs.
FM 17-79, Para. 1-41; FM 17-80, Para. 1-18.

4. Tank Guns: Functioning and Malfunctioning, Maintenance, Record System ..... 4 Hrs.
FM 17-79, Para. 7-9; FM 17-80, Para. 10-12.

5. Operation and Use of the Range Finders M12 and M13—2 Hrs.
FM 17-12, Para. 208-214; FM 17-79, Para. 29, 32, 33.

6. Practical Exercise: Use of the Range Finder ..... 2 Hrs.
FM 17-12, Para. 208-214; FM 17-79, Para. 29, 32, 33.

7. Direct Fire Sights ..... 4 Hrs.
FM 17-79, Para. 25-41; FM 17-80, Para. 35-51; TF 17-2288, 2289, 2290, and 2291.

8. Range Determination—2 Hrs.
FM 17-12, Chap. 5; TF 17-2425.

9. Conduct of Fire, Including Adjustment of Artillery Fire—4 Hrs.
FM 17-12, Chap. 7; FM 17-79, Chap. 4; FM 17-80, Chap. 5.

10. Mechanized Training—.30 Caliber Machine Gun—2 Hrs.
FM 23-55, Para. 1-44; FM 17-79, Para. 11, 14, 93; TF 17-2384.

11. Mechanized Training—.50 Caliber Machine Gun—2 Hrs.
FM 17-79, Para. 11-14; FM 17-80, Para. 16-18; FM 23-65, Para. 1-28, 39-40.

RECAPITULATION

I.	GENERAL SUBJECTS	16 Hours
II.	COMMAND AND STAFF	28 Hours
III.	COMMUNICATIONS	12 Hours
IV.	AUTOMOTIVE	12 Hours
V.	WEAPONS	28 Hours

(U. S. Army)

☆☆☆☆

GENERAL LYMAN L. LEMNITZER

The Twenty-First Chief of Staff

The Chief of Staff,

General Lemnitzer graduated from USMA in 1920 and was commissioned in the Coast Artillery Corps. Graduating from his Officers' Basic Course at Fort Monroe, he was assigned to the 10th Coast Artillery Regiment, Fort Adams, Rhode Island. Following a tour in the Philippines he returned to the States in 1926 and became an instructor at USMA in the Department of Natural and Experimental Philosophy. Attending the Battery Officers' Course in 1930 he returned to the Philippines in 1931. In 1934 he returned to USMA for one year as an instructor prior to entering C&GSS. Following graduation he became a tactics instructor at the Coast Artillery School. After a three year tour there he attended the Army War College, graduating in 1940. Following a short tour as an antiaircraft artillery battalion commander, he joined the War Plans Division of the War Department General Staff. He assumed command of the 34th AAA Brigade at Norfolk and preceded his outfit overseas in August 1942. Assigned additional duties on General Eisenhower's staff, he was charged with planning and early operations of the Allied invasion of North Africa. In this capacity, in October 1942, he accompanied General Mark Clark in the secret submarine mission to North Africa to facilitate the Allied invasions and occupation which took place a month later. Moving to North Africa as a member of AFHQ, he led the 34th AAA Brigade in Tunisia and in the landing phase in Sicily. In July 1943 he was transferred to 15th Army Group where he was CG of the U. S. contingent and Deputy Chief of Staff to the CinC, General Sir Harold Alexander. In this capacity he was active in the discussions with representatives of Marshal Badoglio which led to the capitulation of Italy. In December 1943 he became Deputy Chief of Staff to Field Marshal Alexander, the Supreme Allied Commander, Mediterranean. In this position he took part in the discussion of military operations with Marshal Tito for final military operations of Allied and Yugoslav armies. He also took part in the discussion with the Soviets on final operations against the German armies in Southern Europe. Later he entered Switzerland charged with the management of Allied discussion with the German High Command resulting in unconditional surrender of German armies in Italy and Southern Austria. Subsequently he returned to the U. S. and was Senior Army member of the JSSC, JCS. In 1947 he was appointed the Deputy Commandant of the National War College. He had additional duties as head of the U. S. delegation of the Military Committee to the Brussels Pact. He next became the first Director of the Office of Military Assistance. During this time he attended as a U. S. member many NATO conferences. Completing his Airborne training in November 1950 he assumed command of the 11th Airborne Division. Next he commanded the 7th Infantry Division during hostilities in Korea. Returning Stateside in July 1952, he was DCS for Plans and Research, D/A. In March 1955 he became CG, USAFFE and Eighth Army. He succeeded General Taylor in June of that year as CinC, Far East and United Nations Commands and Governor of the Ryukyu Islands. In July 1957 he became Vice Chief of Staff, D/A, the position he held prior to his present appointment. During this time he was the U. S. Military Representative to observe the fifth and sixth meetings of the Military Committee of the Baghdad Pact Organization. We congratulate General Lemnitzer on his new appointment and pledge him the Association's support in his challenging task.

(U. S. Army)

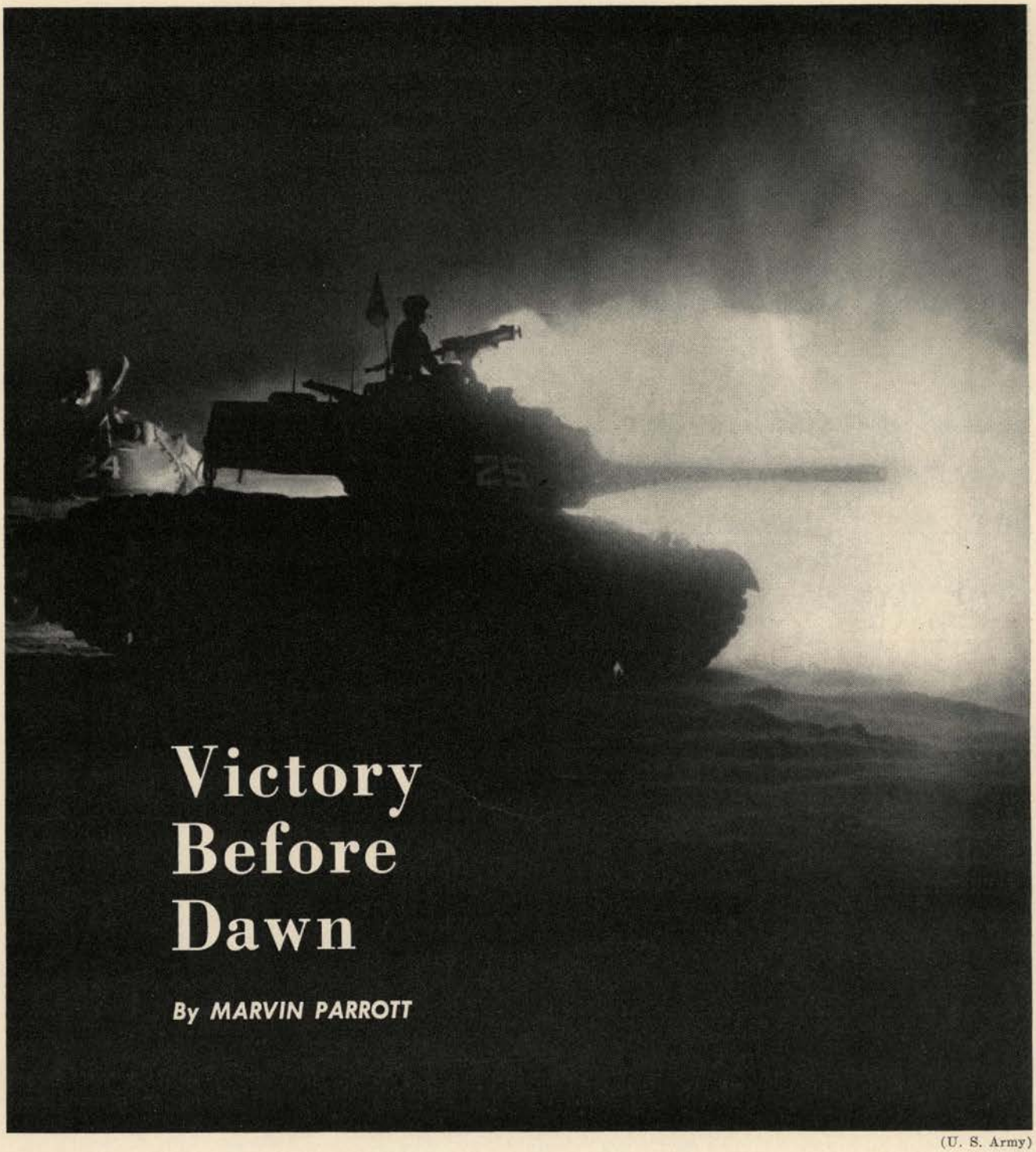
☆☆☆☆

GENERAL MAXWELL D. TAYLOR

The Retiring Chief of Staff

United States Army

General Taylor graduated from USMA in 1922 and was commissioned in the Corps of Engineers. Following attendance at the Engineer School he was assigned to the 3d Engineer Regiment at Schofield Barracks, Hawaii. In 1926 he returned Stateside and transferred to the Field Artillery. After a year with the 10th Field Artillery he went to France for language study. A year later he became a French instructor, and subsequently an assistant Spanish instructor at USMA. In the period 1932-34 he attended the Field Artillery and C&GS Schools. In 1935 he was stationed with the American Embassy in Japan, later the embassy in China. Returning to the States in 1939 he attended the Army War College. On completing this course he went on a special mission to various Latin American countries in connection with Hemisphere defense. Following a tour as a field artillery battalion commander he was assigned to the Office of the Secretary of the War Department General Staff. In July 1942 he became Chief of Staff of the 82d Airborne Division where he was instrumental in the development of the first U. S. airborne divisions. At the end of 1942 he became Division Artillery Commander and went overseas with the 82d Airborne, with whom he participated in the Sicilian and Italian Campaigns. During this period he entered Rome 24 hours ahead of the planned invasion of Italy to confer with leading Italian authorities so as to be able to inform the Allied commander on the feasibility of airborne drops in the Rome area. During the Italian Campaign he was initially the senior U. S. member of the Allied Control Commission in contact with the Italian Government. A year later, in March 1944, he was appointed Commanding General of the 101st Airborne Division which he led in the airborne invasions of Normandy and Holland in June and September 1944 respectively. He also led the Division in the Ardennes and Central European Campaigns. In September 1945 he returned to the U. S. and was appointed Superintendent of the United States Military Academy. In 1949 he was again assigned to Europe as Chief of Staff, EUCOM, and subsequently became the first U. S. Commander of Berlin in September of that year. In 1953 he returned home as Deputy Chief of Staff for Operations, G3, later DCS for Operations and Administration of the Army General Staff. In early 1953 he assumed command of the Eighth U. S. Army in Korea, and participated in some of the bitterest fighting of the Korean War. Following the Armistice he was responsible for the instituting of a vigorous training program for UN forces in Korea to include the ROK Army. Additionally, four historic post-armistice operations were carried out during General Taylor's period of command. These were: Operations Little Switch; Big Switch; Comeback and Glory. These four operations exchanged sick and wounded; returned POWs; repatriated more than 21,000 Chinese and North Koreans who had renounced Communism; and returned more than 17,000 bodies of personnel killed in combat during the Korean hostilities. Under General Taylor's supervision the Army of the Republic of Korea was built into a 20-division force. In November 1954 he was placed in command of USAFFE and Eighth U. S. Army. In the Spring of 1955 he assumed command of the Far East and United Nations Commands. On 30 June 1955 he was sworn in as Chief of Staff of the Army. To General Taylor, who has had a full and illustrious Army career during both peace and war, we give accolades for a job well done and wish him the best during his retirement.



Victory Before Dawn

By MARVIN PARROTT

(U. S. Army)

The importance of learning all we can about night fighting strikes home when we realize that an enemy, properly equipped for and trained in night warfare, could wage a successful offensive in the dark and then defend the newly won position in the daytime.

EXTENSIVE research dealing with various aspects of armor night operations is being pursued by the Human Resources Research Office, Armor Unit, Fort Knox, Kentucky. This scientific work has been in progress since 1955. The project, appropriately named ARMOR-NITE, has two objectives: to identify training problems inherent in armor night operations and to develop effective training methods for successful night fighting.

The use of searchlights and other means for improving visibility during night combat is of course not new. Searchlights were first used in 1863 during the siege of Fort Wagner, Charleston, South Carolina. And they have been used in nearly every major war since that time. They were used with success in the Spanish-American War, the Russo-Japanese War and in World Wars I and II. But searchlights were not used with tanks until 1939. At that time the British placed lights on their tanks in order to have additional visual aid while they were defending the Suez Canal at night. Wishing to surround this device with some secrecy they aptly termed the tank-mounted searchlights as CDL vehicles (Canal Defense Lights). However, except for the Russians, little use was made of this equipment during World War II.

The most successful use of tank-mounted searchlights occurred during the Korean conflict when a Marine Corps tank battalion supported a Turkish brigade. After the sundown to sunup battle was over there were numerous enemy casualties, including more than 700 dead. The United Nations forces had suffered only minor losses!

But before Korea, men and machines generally settled down at night to wait for morning. At night there were sporadic firing, artillery barrages and bombing raids, it is true. But on the whole, battles subsided because soldiers did not fight at night. It was not that night fighting is impossible; it was rather that man had not been taught *how* to fight in the dark. In full realization of these facts, the military decided to gather, through scientific research, more knowledge concerning night combat. For they understood the possibility that a decisive battle may be over before the sun rises. It is not hard to visualize an enemy, properly equipped for and trained in night warfare, waging successful offensive war in the dark and then defending the newly won positions in the daytime.

The importance of learning all we can about night fighting is emphasized by listing the benefits which will accrue from a successful training program in night operations. First, we will have the element of surprise on our side—the kind of surprise which sends a line of tanks moving towards the enemy with probing 18-inch searchlights and belching guns. Also the lights could be very effective in deceptive actions. Simply by turning the light on for brief periods and moving, then flickering the light, just enough to assure the right direction is being taken and the location of the enemy is known would allow our forces to advance rapidly towards his lines.

Another advantage in using tank-mounted searchlights is that troops and vehicles can move with the tanks and not be readily detected. This can be accomplished by placing supporting troops or vehicles just outside the searchlight beam. Still other advantages in using the 18-inch searchlight are that it is almost impossible to estimate the distance to a vehicle mounting a searchlight because it is impossible to see anything except the white piercing shaft of light. Even the terrain that is visible just before the viewer's eyes appears in deceptive streaks of light and shadows. And if the enemy is unable to estimate distance, then how will he be able to knock out our advancing men and machines?

Many people will of course say that a searchlight mounted on a slow moving tank can be knocked out with rifle fire. This is not true. Previous studies clearly establish the fact that searchlights are difficult to knock out by small arms fire, machine gunning aircraft or artillery fire.

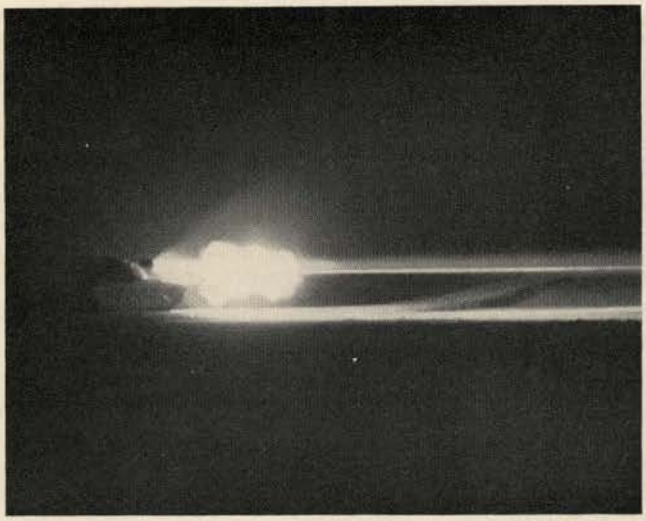
Research on night visual aids must include other lighting equipment as well as searchlights. Investigation concerning our binoculars, telescopes and periscopes should prove enlightening. And research on our infrared and ultraviolet equipment is necessary. Also, the use of flares and other pyrotechnics should be fully explored. Extensive research into each of these areas and wider distribution of this equipment should prove beneficial in case of a future conflict.

The improvement of lighting is not the only factor to be considered in preparing for research into night operations. The other senses must be utilized by the soldier of tomorrow. He must learn to use his ears as well as his eyes. The direction, distance and size of enemy units can be estimated by men who have been trained to use their ears. If this statement sounds far fetched think of what a blind man can do—and all because he has trained his ears. The sounds made by different vehicles over different types of terrain can be studied. Sounds connected with the marching or advancing of different numbers of troops, the firing of various kinds of weapons and other battlefield noises will be investigated thoroughly.

His other senses—touch, smell and taste—will also be of assistance to the dusk to dawn soldier. A scout who has been trained to recognize smells could furnish information which would help destroy the enemy. His keen sense of smell could detect cooking foods; smoking fires; latrines; recently fired artillery shells; transportation supplies, such as gasoline; and ether, alcohol and medicines which are being used at medical posts. Think what information a man could accumulate when he could see less than ten feet in any direction, if he could draw in through his nostrils all of the enemy's odors from 30 yards away!

Men can also be taught how to use the sense of touch during the darkest night. They can learn to recognize types of vehicles which have passed over a dirt road or field by feeling the place where the wheels or treads have cut the earth. Just by walking over the area and feeling the ground now and then, a scout can tell what kind of terrain his fellow soldiers will have to advance over. By feeling, mostly with his feet, and by using the other senses, he can mark good areas for cover when his unit begins the ad-

MARVIN PARROTT received his AA and BS degrees from the University of Louisville. During World War II he served in the Pacific with the 4th Marine Division taking part in the invasions of the Marshalls, Saipan and Tinian. He is now an assistant editor for the U. S. Army Human Research Unit, Fort Knox, Kentucky.



(U. S. Army)

The tank gunner's ability to score a hit in the dark increases when using the 18-inch tank-mounted searchlight.

(U. S. Army)

A 60-inch searchlight, mounted on a truck bed, shows how targets may be spotted for the tank gunners at night.

vance or has to dig in after a big push. And the sense of touch can certainly be of help in locating barbed wire, mines and other dangerous devices. In total darkness a man with keen feeling ability could save himself from death or injury; a man restricted to using his own eyesight and hearing probably would not live very long.

Taste is another sense which can be developed to assist the night fighter. A soldier who has been trained to use this sense may be able to tell whether the drinking water in wells, streams and rivers is fouled. And a sensitive taste may also be of value to determine if unfamiliar vegetation is edible.

Now that we have reviewed some of the benefits which are attainable through research, scanned the brief history of night warfare and probed into those places where extensive research is needed in night operations, let us examine studies which are under way or which have been recently completed by the scientists at the Armor Human Research Unit. For as stated in the beginning, their role is of major significance. Naturally not all the areas mentioned have been investigated by this scientific team. In fact, those problems which do not apply to armor research will not be studied at this unit. But I feel confident many problems associated with armor night training will be fully explored and solutions will be found.

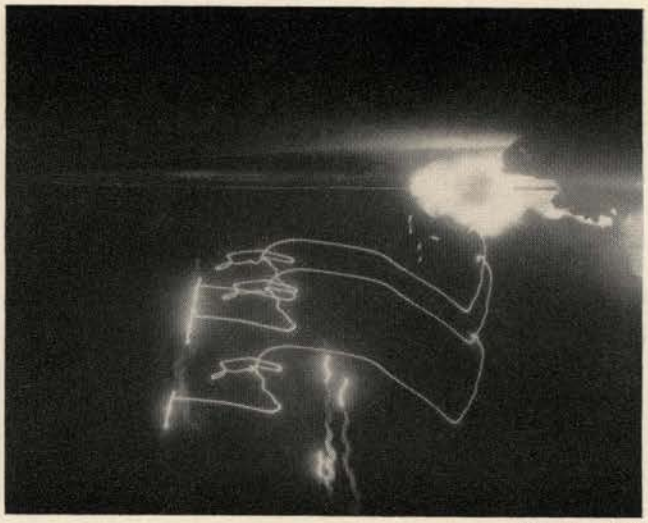
The first work done by the Armor Human Research Unit surveyed the literature on human factors in armor night operations. In this report suggestions for increasing night vision and ways to develop better night training for armor personnel were presented. Our night sights and optical systems were studied for suggested areas of research and ultimate improvement. Various ways to illuminate the battlefield were enumerated, especially those which would be useful to armor personnel. The last phase of this study pointed out additional problems confronting tankers during night combat. The over-all purpose of this study was to define, discuss and determine what was available and what was needed to enable our armor units to move, communicate and shoot as effectively during the night as during the day.

The next study considered how the speed of a tank is affected by illumination and terrain. Contained in this same project was test information dealing with the mental and physical characteristics of tank drivers. This data was used for possible relationship to night tank driving performance. Drivers drove the tanks over five different types of terrain and under four different degrees of natural illumination and five different kinds of artificial illumination. These results should prove helpful in planning night movements and night tactics.

Recently completed is a scientific report on the recognition of approaching vehicles by observers while looking into a searchlight beam. The observers were located 730, 1130 and 1530 yards in front of and at the side of the beam. The purpose of this study was to measure ranges at which approaching vehicles could be detected and recognized on a starlit night while using 18-inch searchlights and also when no illumination was available.

Results revealed that the searchlight does not blind or dazzle the observer as much as was anticipated. In fact, much to the surprise of many people, recognition was the greatest when the vehicle traveled down the brightest part of the beam. And approaching vehicles could not be detected by an observer when he was looking across the light beam. It was only after the vehicles came across or very near the light edge that they could be seen by observers stationed in front of and at the side of the beam. The findings will contribute much to the knowledge that is needed while we are using searchlights in both offensive and defensive actions. The results suggest staying outside the searchlight beam while attacking, that is, advancing with the aid of the beam but just enough outside it not to be seen. In

(U. S. Army)
Machine gun fire from a tank. Notice the backflash from the machine gun appears as a white patch below light beam.



(U. S. Army)
The use of flares during night operations increases the tank crew's chances of scoring a direct hit on its target.

a defensive position, one should try to silhouette an advancing enemy in the beam's light.

Another experiment deals with the effectiveness of 90mm gun fire against the 18-inch searchlight. This research will include recognizing training problems encountered when firing at enemy searchlights and tanks, determining hits on enemy searchlights from distances of 800 and 1500 yards; and determining the amount of time and number of rounds required to hit the enemy vehicle carrying the searchlight. Another program embraces the auditory field. This study will be concerned with the development of training methods for use in recognizing combat sounds. This includes the study of different types of noise which are present during combat, and training of armor personnel to recognize the type, location and distance of specific sounds. A sound laboratory is near completion at the Armor Human Research Unit, and studies are being planned in an effort to teach soldiers to detect and recognize certain combat sounds as they occur against different backgrounds, and to determine something about their source.

Scientific data will be obtained on the factors which influence target detection with an 18-inch searchlight. The objectives are to determine the best position for an observer while he is locating the enemy with the aid of a searchlight beam, and to select the best viewing device to be used (naked eye, binoculars, periscope or range finder). An analysis will be made of the proficiency of the men after they practice on these visual aids. And quantitative data is being obtained on time of detection, accuracy of identification and time and accuracy of laying the gun.

Current emphasis on armor night operations has given priority to research dealing with target detectability under conditions of low natural illumination and of artificial illumination. This interest led to the formation of a contract between the Armor Human Research Unit and the Vision Research Laboratories, University of Michigan. The University has a terrain model complete with surface details, including woods, towns, roads, hills and other features found on all types of terrain. Special illumination equipment is also available which can simulate the sun, moon or any artificial lights. Thorough studies have been conducted on this terrain model with miniature tanks, personnel carriers and other armored vehicles. Also field studies will be made to determine the type and range of targets and the levels of light to be expected under various combat conditions. After this study is finished the Army will have abundant knowledge on ways to detect enemy targets as they are usually deployed under different conditions of illumination.

The latest study now in progress deals with improving the skills required of tank crew members during night combat. The first phase of this program will include an evaluation of present night training in armor; a review of the literature that deals with night operations; observations of night training activities at training centers and in TOE units in the United States and Germany; and interviews with experienced armor personnel in TOE units. The training methods of the U. S. Marine Corps, and of the British, Canadian and French Armies will be examined for solutions to the problems. The next phase will consist of a series of laboratory and field studies designed to solve those problems associated with night training. The last phase will study training problems in night gunnery, driving, communication and maintenance.

This is all of the research in night training that is being conducted by the U. S. Armor Human Research Unit. But it is by no means all that is needed. More research in this area, besides the utilization of what we already know, is required if, in future conflicts, we are to possess the know-how to achieve that decisive victory before dawn.

Editorial

During the past several years technological progress has indicated many new items of equipment which might soon be available for the use of the ground soldier in combat. In addition we have heard a great deal about supporting weapons which will facilitate the ground soldier's mission, which is—closing with and destroying the enemy. These weapons include missiles for increased artillery support, both in range and destruction, flying vehicles which will enable the soldier to get to the area of conflict in a shorter period of time, fast moving full-tracked armor protected ground vehicles and many others too numerous to mention here. Likewise the missions of the other services also support the ground combat soldier. The Air Force, with its long range transportation facilities and strategic capability of destroying enemy civilian support and maintenance installations, assists the individual soldier. The Navy also lends an assist in transportation, amphibian action and fire support during the early phases of an invasion. Regardless of what one reads, hears, or sees, these innovations are made for one express purpose. This is to assist the individual soldier in accomplishing his mission of attacking his target, securing the ground and holding it. These items will never replace the ground combat soldier; indeed today on the nuclear battlefield his position is enhanced.

Because the threat of a possible nuclear holocaust hangs over the World like the sword of Damocles it is highly probable that we will become engaged in the limited type war in case of an emergency during the next decade. Even then in the initial stages we will be forced to employ widely scattered, quickly dispersed and rapidly re-assembled formations due to the possibility that our potential enemy might deem it necessary to use nuclear weapons. Should it become a necessity for us to retaliate with these potent weapons the ground combat soldier will still be required to go in, hold the ground, organize the survivors and repel enemy counter attacks. In fact he will be the forward element until the victory is won and will probably remain there for a long time afterwards.

These new, almost exotic type, weapons are a great step forward. But are they available now? Should we have to go to war tomorrow what will we be required to use? Our present day equipment is the only logical answer to this question. So it seems to this editor that we, of all Components of the Army, must take every step possible to improve our present day equipment. Some of these steps are already in the mill and have been reported in these pages. For example we are replacing the M59 and M75 Armored Personnel Carriers with the M113 which is much lighter and has a lower silhouette and improved mobility. In the tank field we are talking

about the M60 medium tank to replace our present issue M48A2. With the larger 105mm gun, improved ammunition, we increase our firepower. With a diesel engine we increase our operating range. In fact because our present M48A2 can accommodate the new turret, gun and diesel engine, we will be able to modernize our present M48A2s quickly. This is sound economical planning and a tribute to our far thinking Research and Development experts. New rifles and machine guns will soon replace our outmoded models.

But let us take a look at the items now assigned to us for use in training our combat units. We know the limitations and capabilities of these items. But cannot we, as the users, improve on these items? I believe we can and should. At the same time we should publicize the results so that other units and their commanders can benefit by our experiences. (We here at *ARMOR* are only too happy to cooperate in the publishing of such achievements.)

Due to the decrease of the budget we must take every precaution possible to keep our present day equipment rolling. This can be obtained only by superior maintenance and superior employment. This requires a thorough knowledge of these items. We, as the users, must be familiar with every nut and bolt of a combat vehicle. We must know what the firepower limitations are; we must be cognizant of its ability to surmount obstacles whether they are man made or natural barriers. And we must explore the possibilities of extending the vehicle's capabilities. Only by such a thorough inspection of our present day items of equipment will we be prepared to fight tomorrow's battle today. We cannot expect our Research and Development personnel to come up with all the answers. And in different geographical locations where United States Army troops are stationed around the world our problems are not necessarily the same. An excellent example of this situation is the authority given the theater commander to substitute medium gun tanks for light gun tanks in the Armored Cavalry Regiments as he deems it necessary. This has been accomplished in Seventh Army. Therefore it behooves each and every one of us to give it a maximum effort. We do not want another Pearl Harbor or Korea. We must be prepared for whatever exigency comes along today.

To sum up our thinking, we need people with long vision to look far into the future and come up with ideas which will keep us the best equipped Army even 20 years from now. But we, as the users of present day equipment, must demand the maximum effort in maintaining, employing, and improving what we have today for tomorrow's conflict.

A commander of an Armored Cavalry Regiment gives comments and guidance to a newly assigned

Reconnaissance Platoon Leader

By COLONEL WILLIAM E. POTTS

AS the Third United States Army prepared to break out of the Normandy Beachhead in the vicinity of Avranches, General Patton said, "More responsibility will fall on the shoulders of the mechanized reconnaissance platoon leader than perhaps any company grade officer in the Army. On the timely information he obtains, senior commanders will make decisions. The security that he provides will greatly contribute to the employment of highly mobile forces." This statement, true in 1944, is even more significant on today's atomic-nonatomic battlefield.

This week you will take command of a reconnaissance platoon, a small but potent combined arms team that can accomplish miracles when properly trained and led—a platoon that requires the utmost in teamwork and professional competence from every man. You are fortunate indeed in your first command to have the opportunity to control such a variety of combat tools. If you learn early the basic fundamentals and operational techniques for the employment of the integrated reconnaissance platoon, you will have mastered the first step toward becoming a successful battalion commander in the future.

The platoons you are to join have recently been rated at a high state of combat effectiveness. Equipment and personnel are in outstanding condition. Your mission is to maintain your command at its present high standard and to improve its effectiveness to the best of your ability. This is a real challenge to your professional ability and I offer the following points as guidance:

- Your success is based on the work and accomplishments of your men. Know each man. Know his strong and his weak points, and be ever conscious of his welfare and his needs. Remember that a successful command is based on strict discipline and that you must set the example in all fields.
- To command a reconnaissance platoon requires detailed knowledge of tanks, scouts, armored infantry and mortars. Your weapons will range in size and power from the bayonet and carbine to the 4.2 inch mortar and 90mm gun, including three different types of machine guns. You must rapidly become an expert in employing this wide range of firepower to accomplish any assigned mission.
- Your platoon is a highly mobile and flexible force that will cover great distances and wide frontages very rapidly. Therefore, you *must* have effective communication. Know your radio equipment, your radio-telephone procedure, and the techniques and requirements of communication security.
- You are responsible for a section of M48A2 tanks, seven additional wheel and track vehicles, eight radio sets and a great quantity of other equipment. Daily maintenance on this equipment will insure your constant readiness for any alert or emergency. Your contribution to this Regiment is directly proportional to the status of your maintenance effort. I will accept nothing but the highest standards in this field—there are no short cuts.
- Each section and squad of your integrated command plays a specific and definite role in accomplishing the platoon mission. However, successful employment of your platoon will often depend on the effectiveness of your scout section. These scouts must be highly trained and dedicated men with the courage to accomplish any assignment. Each man must be an expert in both daylight and night operations. He *must* have the cunning of an Indian brave, the ability to obtain and report factual information and to kill silently if required. He must demonstrate initiative, aggressiveness, endurance and be one of the best "all-around" soldiers in the military service. Always maintain a highly trained scout section; it will save you many problems in the future.
- The ability of you and your noncommissioned officers to read a map and to "read" the ground, to analyze the military aspects of the terrain, will be of critical importance in the accomplishment of most missions you will receive. Develop the habit of constantly studying the ground on which you train and operate.
- The members of your platoon serving on the border between East and West are entitled to the finest leadership in the Army. If you follow a planned program, you can increase your skill as a military leader each day. Remember that enthusiasm is the basis of a successful command.
- Reconnaissance and security are continuous in any operation. This requires that you be in top physical condition at all times. The success of your command also depends on your mental health and alertness.
- And finally, attention to duty, high professional standards and the positive approach to each problem, though they may not be the only keys to perfection, are the keys to being a successful platoon leader in this command.

I welcome you to the 14th Armored Cavalry, a proud organization of officers and men dedicated to the military service and to maintaining their Regiment at the highest state of combat readiness.

COLONEL WILLIAM E. POTTS, Armor, received his BS and AB degrees from Maryland and George Washington Universities respectively. During World War II he served in Europe with the 2d ACR. He commanded the 72d Tank Battalion in Korea. Now Regimental Commander of the 14th ACR in Germany he has held every command position in an Armored Cavalry Regiment from Reconnaissance Platoon and Tank Platoon Leader including his present position.

(U. S. Army)

Reading from left to right: First Lieutenant Richard D. Lawrence, first academically and recipient of the U. S. Armor Association trophy; General Bruce C. Clarke, Commanding General, USCONARC and graduation speaker; Captain William C. Rousse, second academically and Captain John H. Tipton, Jr., third academically. Advance Class had 188 graduates.

U. S. Armor Association Award

General Bruce C. Clarke, Commanding General, U. S. Continental Army Command, was the principal speaker at the graduation of the Armor Officers' Advanced Class.

The honor graduates were number one academically, First Lieutenant Richard D. Lawrence; number two, Captain William C. Rousse; and number three, Captain John H. Tipton, Jr.

Lieutenant Lawrence is now en route to his new station, the University of Southern California, for further schooling. Captain Rousse is scheduled for flight training at Fort Rucker, Alabama and Captain Tipton's next assignment is to USAREUR.

The number one graduate, Lieutenant Lawrence, received the award sponsored by this Association which is a Revere silver bowl appropriately inscribed. This is the third year that the Association has given this award to the top graduate.

In his address, General Clarke told the 188 graduates that the future of Armor in the 1960's lies in the improvement of current basic weapons. Said General Clarke, "Our future lies in increasing our firepower, mobility and flexibility, in enhancing our ability to operate at night, and our ability to operate in semi-independent task forces."

A former Assistant Commandant of The U. S. Army Armor School, the General outlined what is being done to increase Armor's potential in terms of firepower, operational range and capabilities for night operations and for operation under conditions of limited visibility.

The CONARC commander said that as a final measure every possibility to improve training and reduce training time is being explored.

"You will note that I have not pictured Armor of the future in terms of flying tanks, exotic weapons and radical changes in organization and employment. All recommendations for radically new weapons, organizations and equipment are evaluated to determine if they increase our capability to defeat our potential enemy and if we can afford them in terms of personnel, logistical support and funds."

We congratulate these three top winners and wish them success in following assignments. We also wish to take this opportunity to congratulate each one of the 188 graduates. We are sure each of you is taking with you a great deal of added professional military knowledge which will greatly assist you on your various assignments for years to come. Good luck to each of you.

Since the name of Field-Marshal The Viscount Montgomery of Alamein is appearing in print these days, this historic account of the hurried shipment of the 2d Armored Division Sherman tanks to him in time for the Battle of Alamein, may be of interest to American tankers.

2d Armored Division Tanks at Battle of Alamein

By LIEUTENANT GENERAL WILLIS D. CRITTENBERGER, U. S. Army, Retired

THE 2d Armored Division received the newest American tanks—The Sherman—in June of 1942.

About the same time, the new 105mm Self Propelled Artillery, also arrived at Fort Benning. And with this very latest armored equipment, the "Hell on Wheels" division became the most modern equipped armored division in the United States Army, if not in the whole Allied Forces.

All American armored divisions would ultimately get them—and the Priests, too (as the new 105mm Howitzers on tracks were called later by the British).

With the 1st Armored Division already in the British Isles, the 2d Armored had the highest priority for shipment overseas, and was also being equipped with the latest model scout cars, radios, mortars, trucks and ammunition.

In the division we sensed that it would be only a matter of two or three months until our port call came.

Such turned out to be the case. However a number of things were to happen to us in the meantime.

First, Tobruk fell. Rommel's Afrika Korps was on the march. From this distance, it appeared that he was having some measure of success in drawing out separate British detachments and attacking these brigade groups in detail.

Furthermore, Winston Churchill was in the United States. As a matter of fact, he was in the White House, at this critical moment, consulting with his friend, President Franklin D. Roosevelt, over the reverses in Africa, which had left the British Eighth Army, in the words of Sir Winston, "brave but baffled."

In Africa, Field Marshal The Viscount Montgomery, arrived in the Western Desert, and assumed command of the British Eighth Army on 13 August 1942.

Recording this arrival, in his book, *El Alamein To The River Sangro*, published by E. P. Dutton and Company, Montgomery wrote:

> On my journey from England, I had decided that the Eighth Army required a reserve corps, ... consisting primarily of armored divisions. . . . I decided, therefore, that the formation, equipping and training of a reserve corps, strong in Armor, must begin at once; as a matter of priority.

While these events were happening elsewhere, the 2d Armored Division, along with other United States troops, had taken to the Georgia countryside for extended maneuvers.

Our brand new tanks, armored artillery and other equipment were being given the acid test by the users in the field.

And they were measuring well up to expectations, under the close scrutiny of a host of technical and tactical observers who watched their performance day and night.

Most tankers felt, based on this initial performance of the United States' latest armored weapons, that American Armored divisions would give a good account of themselves once they arrived on the battlefields of World War II.

It was right in the middle of these maneuvers, that I received a message late one afternoon, to march the 2d Armored Division, post haste back to our home station at Fort Benning, Georgia.

No reason was given, in this initial message, for the complete change in the maneuver schedule, and the unexpected withdrawal of the maneuver spearhead troops, but it later developed that the message came out of an urgent White House conference between Churchill and the President.

Within the hour, the division was

LIEUTENANT GENERAL WILLIS D. CRITTENBERGER, RET., no newcomer to these pages and to members of the U. S. Armor Association, was the Commanding General of the 2d Armored Division at the time this transfer of equipment took place.

The Sherman (U. S. Army)

on the road, headed back to Benning, miles away.

As time passed, and we were clipping off the miles, fragmentary messages over the command radio pieced out the story.

We soon learned that we were making this forced march back to our home base, there to load our entire division complement of some 400 newest tanks and guns, for shipment by rail that night to a nearby port.

Before reaching the railroad yards at Benning, the rest of the story came out.

Our tanks and guns, the very latest off any Allied assembly lines, were to be sent to Montgomery at Alamein.

At Benning sufficient flat cars had been spotted on sidings. Ramps, cables, engines and crews were ready. And the loading went off like clock work.

By midnight, the trains had pulled out. Shortly thereafter the armor of the 2d Armored Division was transferred to boats for the long trip around the Cape of Good Hope to the British Eighth Army at Alamein.

The next morning, the famous 2d Armored Division, having only 24 hours earlier been judged an efficient fighting machine, stood completely stripped of its combat effectiveness in tanks and artillery.

Accordingly, having complied quickly and effectively with the high level orders which grounded us, I got off a hurried message that day to Washington, requesting that the personnel of the division now be ordered to follow the tanks to Africa—there to man and fight them, in view of our experience with them.

Understandably this was not a part of the emergency plan, and my request was not approved.

Again referring to Montgomery's book, we read his report of their arrival:

> The equipment situation improved rapidly. Sherman Tanks, sent to us at the personal instigation of President Roosevelt, started arriving in the Delta from America in August, and were issued to 10 Corps. In the Sherman we had at last a match for the German tanks. We had moreover a great weight of artillery and there was plenty of ammunition.

Thus the part which the 2d Armored Division tanks played in the battle of El Alamein is a matter of record.

They were the first American Sherman tanks to fight in Africa, giving a good account of themselves.

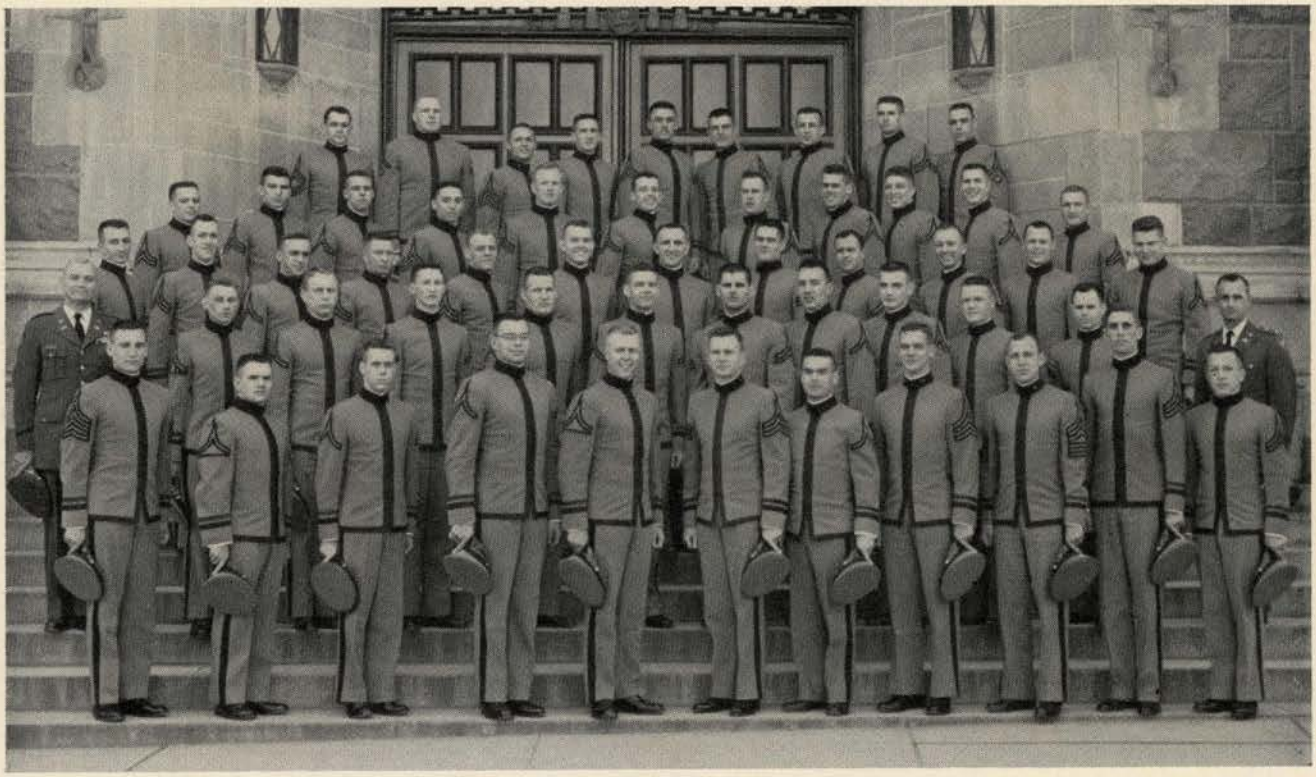
In the 2d Armored Division, depleted so dramatically of all of its armor and artillery, just as it was poised for shipment overseas, the replacement of these battle weapons started immediately. Within a short time the division was again ready to go.

As a matter of fact, it can be stated that the scheduled departure of the division from the United States was not in any way delayed by the loss of its combat equipment to the British Eighth Army that August of 1942.

As time passed, this unique occurrence of a whole American division sacrificing its entire combat power to our beleaguered British allies, was overtaken by events of greater significance. During the war we never thought much more about the matter.

However, after the war ended, in our nostalgic reconstruction of past events, we of the 2d Armored Division frequently recalled the loss of our new Sherman tanks, and hoped that they were in part responsible for Montgomery's victory of Alamein.

Although it has not been my fortune to discuss with the Viscount of Alamein the performance of the American tanks at Alamein, his book indicates that they arrived at the right time. And we Americans can be justifiably proud of their battlefield effectiveness in the hands of our courageous British Allies.



Left to Right, 1st Row—N. S. Krawciw; R. R. Maglin; R. M. Miner, Jr.; E. Bagdonas; C. A. Weaver, Jr.; L. C. Ranch; E. L. Oliver, Jr.; C. P. Hutton; S. M. Kanarowski, Jr.; J. H. Coreth; D. C. Gruschow. 2d Row—Lt. Col. R. P. Campbell, Jr.; J. F. Carroll; A. P. O'Meara, Jr.; J. M. Nash; H. V. Ivey; P. G. Sheaffer; M. Morales; A. J. Morefield; B. R. Bertils; J. L. Massey, Jr.; R. H. Edwards; Maj. D. F. Hering. 3d Row—D. B. Marsh; J. A. O'Brien; C. S. Webster; G. H. Heath, Jr.; W. A. Fitzgerald, Jr.; D. C. Coen; R. W. DeMont; W. M. Burleson, Jr.; J. S. Wilson; R. L. Schnick; R. Letchworth; P. L. Yeats. 4th Row—J. S. Hahn; C. M. Lutz; D. T. Matthes; F. M. Franks, Jr.; H. T. Servis; R. W. Bell; J. H. Ruth, Jr.; H. R. Versace; C. R. Bertolett; C. J. Mansfield, Jr.; D. L. Smart. 5th Row—W. H. Zierdt, III; F. L. Wilmoth; J. L. Abrahamson; M. L. Plassmeyer; T. W. Simroe, Jr.; R. A. Quinn; T. L. Moorhead; R. W. Beale, III; L. H. Shuck, Jr.

United States Military Academy Class of 1959 Armor Graduates

On the third of June this year these 53 cadets were graduated from the United States Military Academy, received their Bachelor of Science degrees and commissioned in Armor.

The Honorable Henry Cabot Lodge, United States Ambassador to the United Nations, made the graduation address. The Superintendent, Lieutenant General Garrison H. Davidson, presented the diplomas.

The 53 total for Armor represents the maximum number allowed on the sliding scale used for branch selection into the combat arms.

Judged by any standards, the potential of this outstanding group of officers is extremely high and varied. Four members of this group wore academic stars, including the first, third and fourth men in the class. Two of these three have been selected as Rhodes Scholars and will study in England for the next two years. Of this group 20 were cadet officers including one regimental and two battalion commanders. Two were captains of varsity team sports. One man stood number one in physical education and another is an All-American track performer. There are nine holders of major "A"s and five winners of minor "A"s for intercollegiate athletic competition. Rounding out this group, are the class secretary, four members of the honor committee, the directors of both the glee club and the cadet orchestra. Practically every extra-curricular activity is represented and many of them held elected office positions during their first class year.

Letters of welcome signed by the Association President were sent to each newly commissioned officer in the mobile arm. Letters signed by the Secretary, notifying each graduate that he had been awarded a one-year membership in the Association, were also sent. In addition copies of *Tank Commander's Guide*, *Tank Company Commander's Guide* and *Notes on the Training of an Armored Division* were given each graduate through Lieutenant Colonel R. P. Campbell, Jr., Chief of the Armor Section, Combat Arms Detachment.

The U. S. Armor Association welcomes these newly commissioned officers into the mobile arm and wishes them a long and successful career in the United States Army.

Timothy F. Currie
Alabama Poly Inst.

Richard E. Hohl
University of Illinois

Ronald E. Craven
Massachusetts Univ.

Josef C. Jordan, Jr.
Norwich University

Herbert E. Whalen
Texas A&M College

Donald M. MacWillie, Jr.
Virginia Mil. Inst.

Outstanding Senior 1959 ROTC Armor Cadets

The six graduating cadets depicted above received this year's Association awards as the outstanding cadets in the institutions where the Armor instructional course is still in effect. Next year there will be only five colleges still on the Armor program as Texas A&M College will be converted to the General Military Science curriculum.

The awards consisted of a package of books given to each recipient and a one-year honorary membership in the Association.

Awards also were given to some 165 institutions under the General Military Science program. This is the first year we endeavored to cover the entire field under the ROTC program. To date the letters we have received from various PMS&Ts have been most gratifying and we hope to be able to continue this program in the ensuing years. Where there were no graduating cadets going into Armor we advised the PMS&T to give the award to a worthy recipient who had chosen another combat arm. As we consider Armor the combined arms team, it is indeed fitting that we do not limit our awards to institutions under the Armor program or to recipients that are commissioned solely in the Armor branch.

Many of these graduates have been tendered appointments as Second Lieutenants in the Regular Army upon graduation. To those who have accepted we welcome you into the Service and wish you success. To those who are following other professions and who will be in one of the Army Reserve Components we wish you well and are happy to know that you are backing up our first line of defense. Also may you be successful in your chosen career.

Much of the work of the Commissioned and Noncommissioned officers stationed at these colleges goes unheralded. The opportunities to spread favorable Army public relations are many. And we are well aware that many of you fit into the civilian communities and do a great deal to support the Army's program. A fine example of this is the excellent article on STRAC which appeared in the May-June issue of *ARMOR*. We offer congratulations to all connected with the ROTC program.

NEWS NOTES

The Annual Research Task Summary

ARTS, the Annual Research Task Summary of the Army, giving information on the current status of more than 2300 Army research projects, has been placed in distribution channels.

For the first time since the Annual Research Task Summary was initiated five years ago, the major portion of the report, six of nine volumes, is being made available this year for more general public use. Purpose of the summary is to provide a factual basis for review and analysis of the Army's research program, to provide information to facilitate internal coordination of the program, and to effect coordination with research supporting organizations outside of the Army.

The Army research program involves a current annual expenditure of approximately $88,000,000 on various projects. Encompassing ten major scientific fields and 74 sub-fields, projects are carried on by agencies at 59 Army installations.

Directed principally through the Army Technical Services—Quartermaster, Signal, Ordnance, Chemical, Transportation Corps, Corps of Engineers and the Medical Service—the research program involves nearly 400 colleges, universities, nonprofit institutions and outside contractors.

Only volumes one through six, all unclassified, will be available to the general public. The titles and price of each of these six volumes follow: Volume I—Biological, Medical, Social and Behavioral Sciences and Operations Research, $3.25; Volume 2—Chemistry, $2.00; Volume 3—Physics (Part I), $3.50; Volume 4—Physics (Part II), and Mathematics, $3.00; Volume 5—Geophysical Sciences and Engineering, $4.75; Volume 6—Materials Technologies, $2.75.

The unclassified volumes may be purchased from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

Purchase of APCs

Food Machinery and Chemical Corporation, San Jose, California, was awarded a $34,033,327 contract for 900 M113 armored personnel carriers with equipment. The San Francisco Ordnance District, San Francisco, California, awarded the contract.

Army Awards Contract for Initial Production of M60s

Chrysler Corporation, Detroit, Michigan, was awarded a $2,800,000 letter contract for engineering services, spare parts and initial production of the new M60 medium tank. This award was made in late May.

Work will be performed at the Lenape Ordnance Modification Center, Newark, Delaware; Chrysler Plant, Scranton, Pennsylvania; and Detroit Arsenal, Detroit, Michigan. The Philadelphia Ordnance District, Philadelphia, Pennsylvania, awarded the contract.

Two Army Contracts for Lacrosse Missile Program

Award of two contracts to The Martin Company, Orlando, Florida, totaling $15,181,000 for additional production of Lacrosse missiles and engineering services, was announced recently by the Department of the Army.

Contracts awarded to The Martin Company for the Lacrosse program since January, 1959, total $25,181,000.

Lacrosse is a surface-to-surface guided missile with nuclear capability. The Army previously announced that the first two battalions to be equipped with the artillery-type weapon were to be activated at Fort Sill, Oklahoma, before the end of June.

An extensive test program of the system has been underway since August, 1957, with both Army and Marine Corps personnel taking part in firings conducted at Fort Bliss, Texas, and the White Sands Missile Range in New Mexico.

A Field Artillery Missile Brigade has been organized at the Artillery and Guided Missile School at Fort Sill, and personnel are now undergoing training with the tactical missile.

Canadian Army personnel also have been trained with the Lacrosse system at the Ordnance Guided Missile School at Redstone Arsenal, Alabama, and at White Sands.

Lacrosse gives field commanders another powerful weapon that could be employed in either limited or "all-out" warfare. It has been assigned roles as both a close and general support weapon.

Lacrosse is about 20 feet long and is fired from a launcher mounted on a 2½-ton truck. All elements of the system are mobile, permitting rapid movement from one area to another.

A Fort Knox National Bank

An organizing committee has been formed at Fort Knox for the purpose of organizing the Fort Knox National Bank there, to replace the facility presently operated by the Citizens Fidelity Bank and Trust Company of Louisville. The Committee expects the bank to be in operation by the first of the year if present plans materialize.

They plan to build a $150,000 building across the street southeast of the Main Post Exchange on land leased from the Government. Ample parking space is available just behind the proposed site.

Examination by the Comptroller of the Currency, the Federal Reserve Bank and the Federal Deposit Insurance Corporation was completed in late April. Favorable action in the form of a provisional charter is expected some time in July.

Until such time as the charter is issued, stock cannot be offered for sale. As soon as legally possible, a prospectus will be issued by the committee, setting forth the terms of purchase and the prospects for the bank. Anyone interested in receiving the prospectus should send his name and address to: Organizing Committee, Fort Knox National Bank, P.O. Box 247, Fort Knox, Kentucky. It is intended to capitalize the proposed bank at $500,000, and interest to date indicates that the amount will be subscribed in a very short time.

Correct Military Addresses

If you have got a beef about the lateness of some of your mail recently, could be you are at fault according to a late survey at postal concentration centers in New York, San Francisco and Seattle.

The survey has revealed that large quantities of APO mail need directory service prior to forwarding to oversea areas.

Chief causes are:

1. Failure to use all elements of a correct return address on mail.
2. Use of unauthorized or unfamiliar abbreviations in return addresses.

Circular 65-3 dated 14 May, 1959, outlines actions to be taken to avoid these needless delays of soldier mail. (Please keep us informed of your complete address so that you will continue to receive *ARMOR* and the Newsletter. Ed.)

World Wars Tank Corps Association to Hold 1959 Reunion

The World Wars Tank Corps Association will hold its 1959 Annual Meeting at Minneapolis, Minnesota, during the period 24-28 August. In view of the fact that this is the same time and location of the Annual Meeting of the American Legion the hotel will be assigned at a later date by the Legion's Convention Committee. For further information please contact: Mr. John J. Conlon, 98-11 Queens Boulevard, Rego Park 74, New York.

Ducted-Fan Airplane Successfully Flight Tested

Successful in-flight transition from vertical to horizontal flight and back to vertical has been accomplished in tests of a rotatable ducted-fan airplane developed for Army use.

Developed by the Doak Aircraft Company, Incorporated, Torrance, California, the Doak 16—known in the Army as the VZ-4DA VTOL (vertical take-off and land) can rise, hover or settle similar to a helicopter. It also can fly straight ahead at high speeds approximating the performance of conventional fixed-wing aircraft.

The tests were made recently at Edwards Air Force Base, California, with full conversion being accomplished in flights from the ground and also at altitudes of 3,000-6,000 feet. At all altitudes tested, the Doak 16 hovered steadily in a stationary position, then returned to normal flight.

Propulsion is furnished by ducted-fans which are mounted on the wing tips and can be rotated through 90 degrees. Pointed straight up, the fans provide lift which permits the raising or lowering of the airplane without use of a runway. After a vertical take-off, the ducts are rotated full forward and the Doak 16 then operates much as an ordinary airplane. For a vertical landing, the ducts are rotated back to the up position and the craft is eased to a landing spot.

With the ducts kept in the forward position, the airplane can take off or land, using an airstrip as a conventional plane. Setting the ducts at an intermediate angle permits short run take-offs or landings. Forward runway take-offs give an advantage in increased payload.

The test plane is powered by a single 840-horsepower Lycoming T-53 shaft turbine engine mounted in the fuselage behind tandem seats for pilot and observer. Its overall span is 25½ feet; length 32 feet; height 10 feet; empty weight 2,300 pounds, gross weight 3,000 pounds.

The engine has a long tail pipe ending in a hinged horizontal and vertical vane arrangement to provide control during low-speed operation and vertical take-offs. Molded plastic skin covers the welded steel tubing fuselage. Propeller blades are of light-weight, tough plastic made by methods developed by the Doak Company.

TOP COMMAND CHANGE

(U. S. Army)
General George H. Decker
Vice Chief of Staff
Department of the Army

(U. S. Army)
General Carter B. Magruder
CinC, United Nations Command
& Eighth U. S. Army

A British Flying Saucer

Recently the British Government unveiled her version of the flying saucer. It operates most efficiently over fairly level ground free of high obstacles.

The saucer, known officially as the *Hovercraft,* or the SRN1, has been undergoing tests. These have been described by chief designer R. Stanton-Jones as coming "absolutely up to expectations." He added, "We got from the machine exactly what we had hoped for."

The four-ton prototype, the invention of 48-year-old Lowestoft boat-builder Christopher Cockerell, is the result of six years' design and experiment—although the actual building, with redesign problems, was accomplished by Saunders-Roe within eight months, with financial help from the National Research Development Corporation.

Purely experimental, the Hovercraft is a new type of vehicle employing a lift principle fundamentally different from that of other craft. Supported on a cushion of air sucked in by a fan and blasted down through vertical nozzles, it operates at heights just sufficient to clear waves or land surface irregularities.

In appearance the SRN1 resembles an inflatable life raft with a funnel-shaped structure (the fan) rising from its center, attached to which is the two-man enclosed cockpit. Oval in shape, the machine is 30 feet long and 24 feet wide. It is powered by an Alvis Leonides 435 h.p. engine driving a 4-bladed axial fan.

It can carry up to 20 people. All-up weight is around 7,500 lbs.

The company has great expectations for the craft—as a fast ferry over medium distances, as for instance across lakes, or even as a trans-oceanic transport vessel.

Unlike an aircraft, the machine has no wings. It can maintain its height (or hover) without forward speed. It is also distinct from a ship since it operates clear of the water. Its resistance to motion is small, allowing it to travel at speeds roughly three times that of the fastest ocean liner with a minimum disturbance to the water.

In a statement released recently the company points out, "The Hovercraft can transport passengers and freight at high speed and low cost, which combination fills a gap in the field of transport vehicles."

It goes on to say, "Although the future of the Hovercraft would appear to lie primarily in operating over water, with loading and servicing on land, it is capable of efficient operation over any surface such as ice, snow, marsh, tundra and desert that is clear of high obstacles."

So far, in tests, the prototype has operated roughly a foot above the earth's surface at speeds of 25 knots. However, later and larger machines are expected to fly at heights of three or five feet at speeds of up to 120 knots.

The power requirement for lift decreases with size, and at an intermediate size of 400 tons only about a quarter of the engine power of an aircraft would be needed to carry up to twice an aircraft's payload.

Riding in the Hovercraft is chiefly remarkable for its smoothness. Test-pilot Peter Lamb has described it as being "like sitting on air cushion." *(British Information Services)*

FROM THESE PAGES

65 Years Ago

A system of skirmishing should be modeled on the needs, not of a mounted, but of a dismounted force, since it then finds its principal use. Our regulations should speak with no uncertain sound on this point.

During the War of 1861-5 our leaders discovered what was then a new role for cavalry and which has added enormously to the value of that arm. What they discovered and developed let us not lose sight of. Some people dub, contemptuously, cavalry trained to fight on foot, "mounted infantry," but it requires merely an absence of overruling prejudice and a little common sense, to be *convinced* that a force which can fight effectively on foot as *well* as on horseback has gained enormously in value as a weapon of offense. Cavalry which can fight on foot can be independent, self-reliant, though not less swift. As an advance guard, a rear guard, a flanking force, a raiding force, cavalry must hereafter be prepared, mounted, to meet cavalry with the saber; and dismounted, with the rifle to capture and hold positions, to resist infantry and to attack infantry.

To state the principle again, skirmish action is a method of fighting dismounted, which finds a very rare and somewhat doubtful application mounted. It is evident, then, that a system of skirmishing should be based upon the needs of dismounted troops, not on the needs of the horse and rider. The size and composition of the fire unit, the method of deployment, must be arranged with reference to dismounted, not mounted fighting.

CAPTAIN JAMES PARKER

Cavalry Extended Order Formations

50 Years Ago

Our mounted troops can now be called very good mounted infantry. They are familiar with the use of their rifles and can ride well on the march, can care for their horses and dismount quickly to fight on foot. The squadron when dismounted becomes a handy little battalion. As much cannot be said for the mounted work. The troops do not charge well, the men are not skilled in the use of the sabre, and the horses are not trained to make the quick answer to the aids necessary for quick work in close order, and which must be so necessary in the melee. Among many officers there is a decided doubt that mounted action, and especially sabre action, is practicable. This is natural, as our wars of the last 30 years have not been of a character which would favor this kind of fighting, and there is a tendency caused by improvements in the range and accuracy of small arms to unduly value rifle fire. This view may be correct, although it is held by the military men of no other nation but our own.

"How, I ask, can the cavalry perform its role in war until the enemy's cavalry is defeated and paralyzed? I challenge any cavalry officer, British or foreign, to deny the principle that cavalry, acting as such against its own arm, can never attain complete success unless it is proficient in shock tactics.

LIEUTENANT K. B. EDMUNDS

Target Practice and Training for Mounted Action

25 Years Ago

Covered by air and armored car reconnaissance the Mechanized Regiment, moving rapidly, secured the bridges at Fort Riley and Junction City by 6:30 p.m. The regiment, less trains, with the motorized battery attached, then moved out to establish contact with and delay the hostile Cavalry Brigade reported to the North.

. . . On receiving information of the advance of the Mechanized Cavalry, the Cavalry School Brigade remained in concealed bivouac until after dark, when it moved south on two secondary roads. In spite of delay by hostile armored cars during the night, it had by daylight placed one regiment of Cavalry and one battery of Artillery between the Mechanized Cavalry and the two bridges, and destroyed the bridge at Junction City. By the same time the other regiment and one battery of Artillery had occupied a strong position in front of the Mechanized Regiment. Just before dawn a concerted attack was launched on the Mechanized Regiment from all directions by platoons with .50 caliber machine guns attached supported by artillery fire.

This maneuver illustrated the greater mobility of Mechanized Cavalry over Horsed Cavalry in a race for a critical terrain feature and brought out the fact that Mechanized Cavalry is unsuited for night operations when opposed, and would have great difficulty in holding a position at night.

The Cavalry Maneuvers at Fort Riley, Kansas, 1934

10 Years Ago

Drone planes may lock in combat, guided missiles may be shot down by automatic antiaircraft guns, driverless tanks may shoot at each other amid all the scientific refinements of crawling magnetic mines and similar machines, but no real victory can be achieved until the living men behind such machines can be eliminated or forced to surrender. As yet there is no substitute for man.

It is a popular American misconcept that dollars will buy most anything, but we have never been able to purchase time. The American public should not be lulled into a false sense of security by the presence of pilot models and blueprints of futuristic weapons. It now requires time to train men for the defense of their country. Even the most elementary positions of a modern defense machine cannot be filled overnight. Given even the best equipment and facilities it still takes months to produce a radio operator for a tank. Dollars cannot shorten this period of training. If this nation were attacked the United States would not enjoy the same period of unmolested mobilization we have had in the past. A declaration of war by an enemy will not be heralded by diplomatic exchanges but by exploding bombs of the aggressor. . . . Science has eliminated, not fathered, the chance of a cheap war.

MAJOR ROBERT B. RIGG

The Cheap War

How Would You Do It?

A PRESENTATION OF THE UNITED STATES ARMY ARMOR SCHOOL

SITUATION

You command a 4.2-inch mortar platoon, which is emplaced in a wooded area approximately 500 yards south of the Mudd River. The area north of the river is known to be occupied by enemy forces. No maps of the area are available, and requests for air photo coverage have not been fulfilled because of heavy fog which has blanketed the area for the past week.

At 0130 hours today the air photo reproduced at the left was taken from the leader of an enemy patrol who was captured as he dismounted from a row boat at Point X. The patrol leader was attempting to burn the photo when he was captured. Upon interrogation, one of the prisoners revealed that the patrol had been dispatched from an infantry battalion headquarters located in a farmhouse about one kilometer north of the river. He further stated that his company had taken shelter in other buildings near the farmhouse. Some of this information is corroborated by markings on the air photo. You recognize the area in which your platoon is emplaced and indicate it to the S3 by circling it (lower left). You receive permission to retain the photo long enough to compute firing data

PROBLEM

How will you determine (1) the azimuth and (2) the range from your mortar positions to the farm buildings which are reported to house the company of enemy infantry?

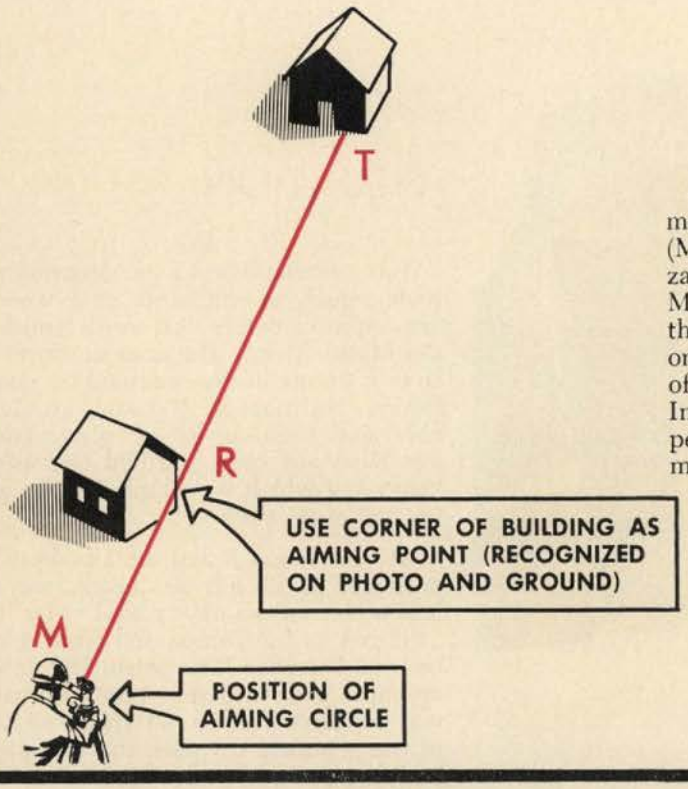
SOLUTION

AUTHOR: CAPT W H PHILLIPS

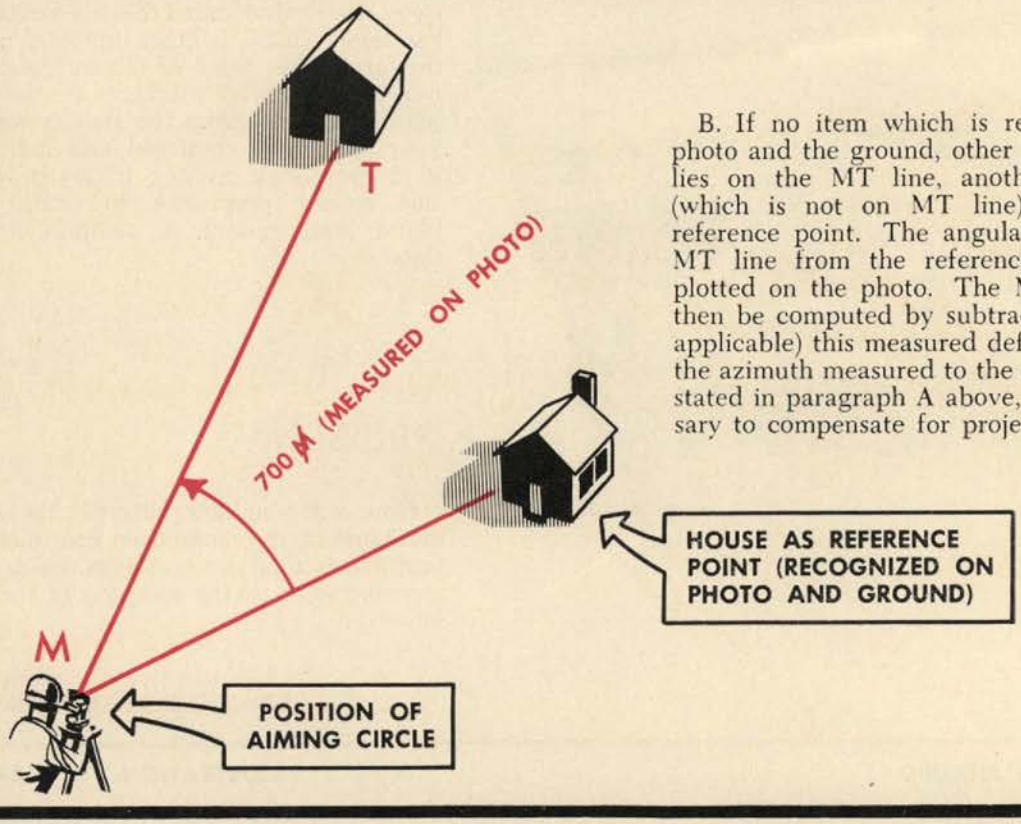
ILLUSTRATION: J H BAIN

solution

1 AZIMUTH

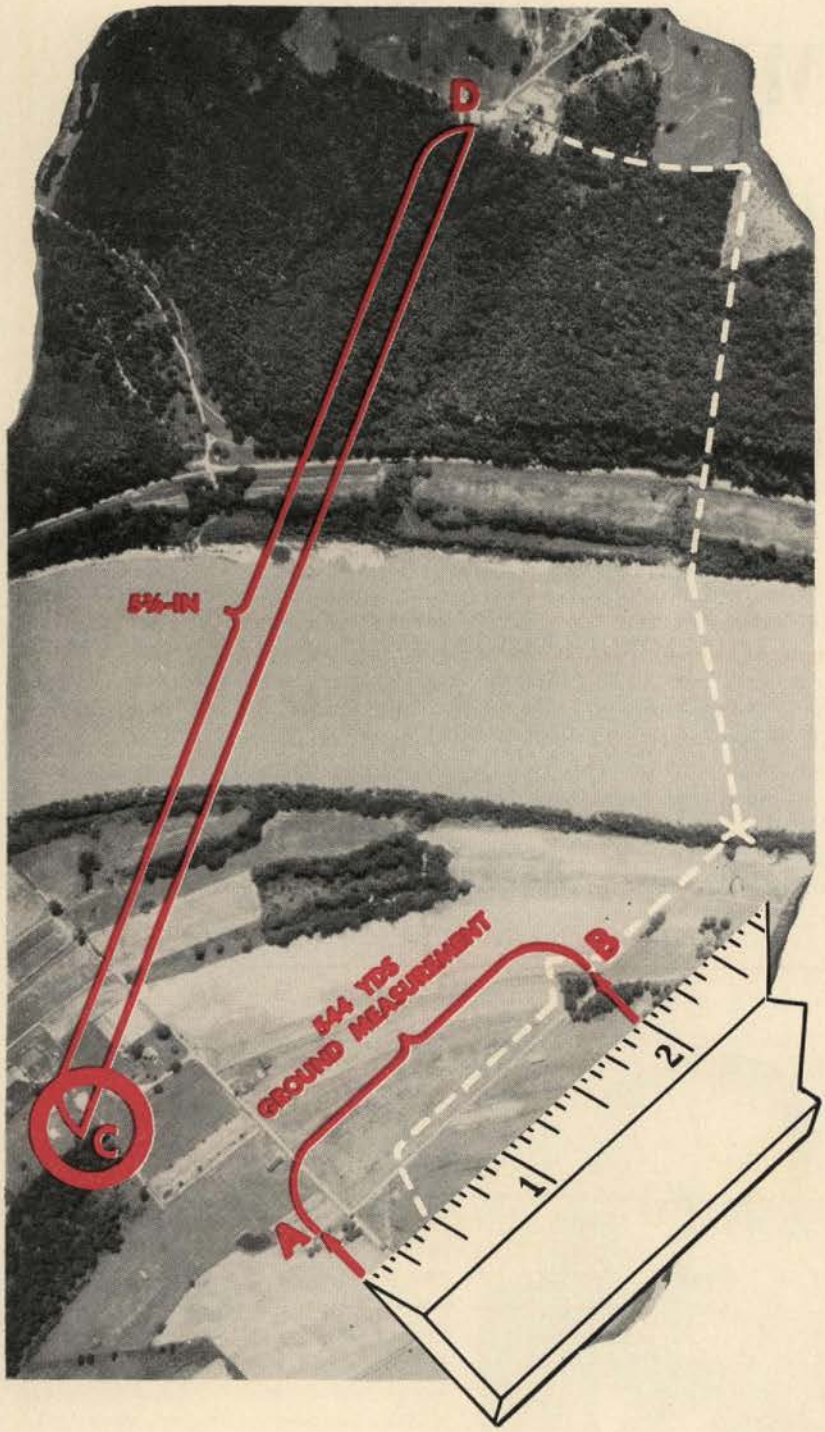


A. The azimuth on which you would lay your mortars is determined by drawing a mortar-target (MT) line on the photo, and then using a recognizable object on the ground which lies on this MT line as an aiming point to which you measure the azimuth. The aiming circle would be placed on Point M and the azimuth reading to the corner of the barn at Point R would be the MT azimuth. In computing your firing data, you must compensate for drift of the projectile in the normal manner after the range is determined.



B. If no item which is recognizable on the photo and the ground, other than your position, lies on the MT line, another suitable object (which is not on MT line) is selected as a reference point. The angular deflection to the MT line from the reference point would be plotted on the photo. The MT azimuth would then be computed by subtracting or adding (as applicable) this measured deflection from (or to) the azimuth measured to the reference point. As stated in paragraph A above, it would be necessary to compensate for projectile drift.

2 RANGE



In order to establish the range, you must determine the scale of the photo. With the information and equipment available to you, the most practical way of doing this is to find the representative fraction (RF).

EXPLANATION

$$RF = \frac{\text{Photo Distance (PD)}}{\text{Ground Distance (GD)}}$$

NOTE: This distance must be measured between two points which are readily recognized on the photo and the ground, and which are separated by a relatively great distance; if possible, the line connecting these points should be near to or across the center of the photo.

EXAMPLE:

$$RF = \frac{\text{PD (AB on photo)}}{\text{GD (actual ground measurement)}}$$

$$RF = \frac{2 \text{ inches}}{19{,}584 \text{ inches (544 yards)}}$$

$$RF = \frac{1}{9792} \text{ or } \frac{1}{9800}$$

Thus, the MT range is computed:

Photo distance (CD) = 5¾ inches

Therefore, ground distance = 5.75 x 9800 or 56,350 inches ÷ 36 = 1565 yards.

(With available information it is impossible to make any range correction for difference in MT altitude.)

THE BOOK SECTION

SWAMP FOX:
The Life and Campaigns of General Francis Marion

SWAMP FOX: THE LIFE AND CAMPAIGNS OF GENERAL FRANCIS MARION. By Robert D. Bass. 275 pp. Henry Holt and Co., New York City, New York. $4.50

Reviewed by Jac Weller

THIS life of Francis Marion is the first to appear in a century and the best ever written. A soldier wanting to study Marion can do so now from a single book. This South Carolina partisan is worthy of study; he was a master of independent fluid warfare as it was fought in the Southern Theater of the American Revolution. There are astonishing similarities to the dispersed actions which may be fought in the future. Marion managed to control territory, yet remain hidden from powerful opponents.

Bass is a professional historian; his work on Banastre Tarleton is very good. He is a native of South Carolina and still lives there. He had done thoroughly the long, careful research necessary to produce a first rate study in the modern manner. He sets forth completely his sources in a separate section of the book for those who wish to delve more deeply into the Revolution in the South. Notes and references do not confuse the general reader in the main narrative.

Bass in his life of Marion shows him as he really was. The earlier biographers—James, Horry and Weems, and Simms—give only a glorified, not very convincing, picture. The Swamp Fox gains much from such a presentation. He was a natural soldier who used what he had to aid enormously in winning what amounted almost to a separate war from the Revolution in the North. At one time, the Carolinas and Georgia were almost completely dominated by Tory-British forces. This was the period of Marion's greatest military activity.

Marion was illiterate, small, old and able to feel human discouragement and anger. Although he had served in the militia on active duty several times, he was not an educated or professional soldier. He lacked the physical prowess and personal wealth

THE AUTHOR

Robert D. Bass, born in the section from which Marion drew his troops, received his AB, MA and PhD degrees from the University of South Carolina. He was an assistant professor there until 1940. He joined the Navy during World War II and was an officer-instructor at USNA to 1946. He remained there as an Associate Professor of English, History and Government and was chairman of the faculty of Composition and Literature to 1957. The author of the well known book, *The Green Dragoon*, he is presently a professor in the Department of English at Furman University, Greenville, South Carolina.

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

Benjamin Franklin

Anyone interested in a true appreciation of an astonishingly modern series of campaigns can gain much from this book. A knowledge of Francis Marion and his methods will be of great value to future American commanders of Armored forces.

of Bedford Forrest. He lacked the assurance and familiarity with command that came easily to his fellow South Carolinians, the Hamptons. These things, carefully brought out, only tend to accentuate the qualities that made Marion great. His knowledge of the Low Country, its people both Whig and Tory, and its natural and cultivated resources was truly remarkable. He knew his troops and those of the enemy. His strategy and tactics were adapted to them. His plans were always within the capacities of the men he commanded. He took advantage of the strong points of his own forces and avoided the consequences of their weaknesses.

Marion lacked almost all training in military theory and science. He made up for it by a practical common sense which amounted to genius. No man ever thought straighter along military lines than this little second generation French Hugenot. Endlessly, he took advantage of a memory for topographical and other details in a country where others can see little even today. He had also the indefinable spark of leadership, not only for those directly under his command, but also the whole population of his area. He was respected even by his enemies; towards the end of the war, many of them found it easy to change sides when Marion asked them to do so.

Bass's book is not without small slips. What book is? However, this biography is simple, truthful and easy to follow both for the casual reader and for the student. It can be used as a field manual by a soldier who wishes to study Marion's campaigns in greater detail on the spot. Firsthand knowledge of the unique South Carolina Low Country is of great importance in understanding Marion and what he achieved. Perhaps Bass gives such a clear picture because he has done the topographical research in detail, as well as that with written records. Anyone interested in a true appreciation of an astonishingly modern series of campaigns can gain much from this little book. A knowledge of Francis Marion and his methods will be of great value to future American commanders of Armored forces.

THE REVIEWER

Jac Weller, also born in the Deep South, graduated from Princeton University in 1936. He has written extensively for several years on military subjects, concentrating on the Civil War and Revolutionary battlefields. Recently he toured Europe in connection with modern Napoleonic and earlier battlefields. He is well noted for his thoroughness in geographical research. A frequent contributor to *ARMOR*, he is the author of more than 70 articles for other periodicals, and three books. He is also an Ordnance advisor to the Department of Defense on old weapons. He resides in Princeton, New Jersey.

Those who have sworn to bear true faith and allegiance to the United States of America and to serve them honestly and faithfully against all their enemies whomsoever, will find that

A Guide to Anti-Communist Action

is an indispensable handbook.

A GUIDE TO ANTI-COMMUNIST ACTION. By Anthony Trawick Bouscaren. 244 pp. Henry Regnery Company, Chicago, Illinois. $4.00

Reviewed by Colonel James N. Peale, Jr.

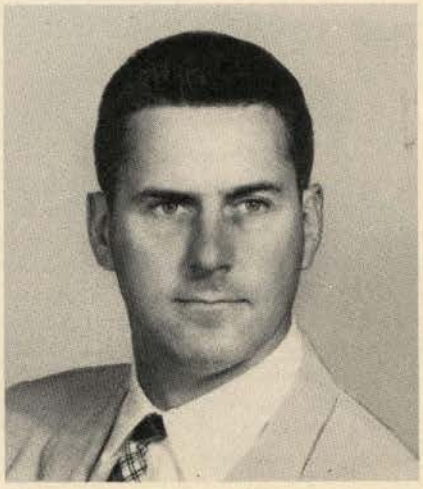
WHEN Deputy Premier Anastas Mikoyan returned to Russia this January he reported that the Americans were favorably disposed towards "peaceful coexistence" and tired of the cold war and he concluded that acts must follow words. Americans are hearing the Communists and their fellow travelers in America clamoring for a summit conference; trade and exchanges of visits; relaxation of vigilance by the Free World; an end of nuclear tests; abandonment of U. S. bases overseas; dissolution of the Free World alliances; recognition of Red China; neutralization of Germany, Japan, Korea and Vietnam; discontinuance of the message of hope to the people behind the Iron Curtain; and prudent retreat from the inevitable advance of communist influence and power. Recommended measures to prevent the progress of Socialism will be labeled as dangerous and contrary to the spirit of peaceful coexistence. The agenda for world discussion will be announced by the enemies of the United States.

The citizen who is alarmed by this turn of affairs usually feels frustrated and helpless to stem the tide of opinion which flows contrary to the national interest. Anthony T. Bouscaren offers a way to overcome this frustration. He explains how to recognize communist propaganda, Communists and their front organizations and what a patriotic American can do in his own community to thwart the operations of this formidable conspiracy.

Bouscaren is well qualified on the subject. He is an associate professor of political science at Marquette University. Recently he took a leave of absence while serving on the faculty of the National War College. He was a bomber pilot in the Marine Corps during World War II and has visited many parts of Europe and Asia, written six books and numerous articles, lectured often, and conducted a citizens' seminar on Communism.

Bouscaren explains peaceful coexistence as a strategem intended to lull the Free World into a state of passivity until the Soviet empire is again ready to resume the offensive,—as a means to "obtain at the conference table what they would otherwise have to obtain by force." He cites Stalin as saying of peaceful coexistence: "We are speaking of temporary agreements with the capitalist governments in the sphere of industry, trade and perhaps diplomatic relations . . . [However] We are not living merely in a state, but in a system of states, and the existence of a Soviet Republic side by side with imperial states for a longer time is unthinkable. One or the other must triumph . . . A series of frightful clashes between the Soviet Republic and the bourgeois is inevitable."

Bouscaren recommends that the United States "adopt liberation from Communism as our long-range objective and convince the enslaved that we mean it." He feels that the United States government "should energetically sell anti-communism to its own people and to its allies. Ours is the choice," he says, "to continue to lose 'World War III,' in which we have lost eight million square miles of territory and 800 million people to Soviet expansion, not to mention 150,000 American casualties in Korea, through the defeatist coexistence policy; or to stir ourselves out of our lethargy im-



THE AUTHOR

Anthony Trawick Bouscaren received his AB from Yale and his MA and PhD degrees from the University of California. He is the author of three books on Communism in addition to this Guide. During World War II he served as a bomber pilot in the Marine Corps in the Pacific. Since the War he has served as a Professor at the University of San Francisco, and University of Loyola. He is presently an Associate Professor of Political Science at Marquette University. Recently he completed a leave of absence during which time he served on the staff and faculty of The National War College, Washington, D. C.

The author explains peaceful coexistence as a stratagem intended to lull the Free World into a state of passivity until the Soviet empire is again ready to resume the offensive—as a means to "obtain at the conference table what they would otherwise have to obtain by force."

mediately and take these effective steps, which alone can lead to ultimate victory and general peace."

In April 1955, he explains, Brigadier General David Sarnoff of RCA recommended a psychological offensive. Sarnoff wrote: "Our potential fifth columns are greater by millions than that of the enemy. But they have yet to be given cohesion, direction and the inner motive power of hope and the expectation of victory." The plan, which antedated the summit conference of 1955, was laid aside.

The reliance of the United States on the deterrent power of nuclear weapons and the diminution of the armies of Western Europe have created, he considers, a trend that is morally and politically to the advantage of the Soviet Union. Bouscaren recommends military establishment capable of fighting either nuclear wars or "brush fire wars," emphasis on research and development and personnel reforms. He states regarding missile warfare. "The time in history is past when this nation can afford to let the enemy deliver the first blow."

The influence of Communists in the United States is multiplied by front organizations, which are sustained by gullible intellectuals. These fellow travelers are often in a position to influence government, publishing houses, radio and television companies, industry and schools and colleges where overt communist propaganda would be rejected. Mr. J. Edgar Hoover numbered these American front workers at 400,000,—or more than ten times the party membership. The Alien Registration Act of 1940 (Smith Act), the McCarran Internal Security Act of 1950, the Communist Control Act of 1954, and the Immunity Act of 1954 formed the legal basis of the Security Program, designed to curb communist influence. However, a number of Supreme Court decisions in 1957 greatly weakened the program and led the *Daily Worker* to say, "the curtain is closing on one of our worst periods."

Soviet espionage in the United States has been aided by *Amtorg*, a trade organization, by diplomats and by reporters of *Tass* and *Pravda*, who are free to travel and use public communication facilities. Many officials have seemed oblivious to the evil motives of Communists in government. In Bouscaren's opinion, the Institute of Pacific Relations, supported by wealthy patrons and dominated by Communists, had great success in deceiving the United States government about the intentions of the Chicoms, cutting off aid to Chiang Kai-shek after World War II, and setting the stage for the communist attack against South Korea in 1950. Bouscaren names many American persons and organizations which have aided the Communists in the fields of education, labor, government and the United Nations. He feels that loyal officials should learn how to identify such people and fronts and should take a firmer stand against their treasonable activities. He concludes that, if five percent of the American citizens joined to fight Communism, the battle at home would be all but won.

No less valuable than the book itself is the appendix. This contains a checklist for individual anti-communist action, a list of 55 American anti-communist organizations, and an extensive bibliography of books, government publications and periodicals which deserve attention and support.

Those who have sworn to bear true faith and allegiance to the United States of America and to serve them honestly and faithfully against all their enemies, will find that this guide is an indispensable handbook.

THE REVIEWER

Colonel James N. Peale, Jr., a 1937 USMA graduate, served in Europe during World War II as an Infantry battalion commander in the 26th Infantry Division. Subsequently, he was an advisor with the Hawaiian National Guard and served in the G3 Section, USARPAC. Next he served in the G3 Section, Department of the Army. In 1954 he became the Senior Liaison Officer, BAOR in Germany. Returning Stateside, he attended the Army War College. Next he was assigned to his present position as Chief, Psychological Operations Branch, Special Warfare Division, Office of Director of Plans, D/A.

The Officer's Guide

This is the latest edition of the greatest professional fact book ever prepared for officers of the U. S. Army. Authoritative, copiously illustrated, interestingly written, it stands as a reliable source for study, reference and inspiration about problems which face the officer as an individual. For more than a quarter of a century it has stood pre-eminent in its field and has served more than 650,000 officers. As always, it is up-to-the-minute in all respects and meets the needs of today's pentomic army. It is almost as essential to an able Army officer as his uniform.

THE OFFICER'S GUIDE provides a ready-reference which is invaluable to officers in the efficient performance of their military duties and in the conduct of their personal affairs. Within its 500 pages you will find pertinent information on hundreds of subjects vital to your career —pay, customs, uniforms, legislation, regulations, organization, schools, personal affairs, efficiency reports, etc. No one could possibly remember the myriad of details contained in this book or keep abreast of the many changes in regulations it briefs each year. Order yours now!

$6.00

PLEASE KEEP US INFORMED OF YOUR CORRECT ADDRESS

ORDER FORM BOOKS BINDERS — *Armor*
1757 K Street, N.W., Washington 6, D. C.

Please send me the following:

_____

_____

_____

_____

_____

_____

NAME (Please Print)

ADDRESS (Street or Box Number)

CITY (Town or APO)

STATE

☐ I enclose $.....
☐ Bill me. (Members only.)
☐ Bill unit fund.

TACTICS II (GAME)

Now you can command an army in the field in this latest version of the chess-like all skill war game that is played in almost every nation in the world. Command Armor, Infantry, Parachute Divisions . . . plans, tactics and strategy . . . every principle of war applies. The only elements of chance introduced into the conduct of play are those inherent in any military operation, such as weather, and your skill as a commander can overcome even those risks.

TACTICS II is fought on a huge 28 by 22 inch full-color mapboard which includes all types of terrain. $4.95.

FORGING THE THUNDERBOLT

By Mildred Hanson Gillie

A study of the growth of the tank and its use in war. Centered around the "Father of Armored Force," Gen. Adna R. Chaffee. A competent and very excellent account of development of American armor. (1947). 330 pages, illustrated. $5.00.

TACTICAL PROBLEMS FOR ARMOR UNITS

By Col. Paul A. Disney

A series of problems for sand table or terrain use. (1952). 214 pages (paper cover), illustrated. $2.50.

ASSAULT BATTLE DRILL

By Maj. Gen. James C. Fry

A detailed explanation of assault battle drill training for combat infantry troops. Book is based on 9-man squad. 114 pages, illustrated. $2.50.

ROOTS OF STRATEGY

By Brig. Gen. T. R. Phillips

A compilation of military classics. Contains battle-tested theories of Napoleon, Frederick The Great, Vegetius, De Saxe, and Sun Tzu. 488 pages, illustrated. $5.00.

MODERN RECONNAISSANCE

A selection of articles from *The Cavalry Journal*. Discusses established principles of reconnaissance and provides an analysis of actual World War II battles. (1944). 230 pages (paper cover), illustrated. $1.50.

ENGINEERS IN BATTLE

By Col. Paul W. Thompson

A collection of magazine articles concerning the action of German Engineer troops during World War II. (1942). 108 pages, illustrated. $2.00.

The PRICE OF SURVIVAL

By Brig. Gen. J. B. Sweet

A brilliant analysis of military strategy in the Atomic age. (1950) 230 pages. $2.85.

TANK COMMANDER'S GUIDE

A masterful, pocket-size condensation of facts a soldier needs to operate tanks, both in combat and in training. It was written by the U. S. Army Armor Human Research Unit, Fort Knox, Ky., after a detailed study of over 90 different field manuals, training circulars, and thousands of interviews with tank commanders.

Over 400 pages, 100 illustrations. Comprehensive coverage of the new pentomic organization, training, intelligence, communication, tactics, and other vital subjects. Innumerable checklists for all types of inspections are included. Paper cover. Illustrated. $2.95.

AMERICAN CAMPAIGNS

By Matthew Forney Steele

Prepared originally for students at the Command and General Staff College, this book offers a comprehensive narrative of U. S. wars and campaigns up to and including the Spanish-American War. This book is generally recognized as the Standard American Military History. 338 pages. $6.00.

BATTLES AND LEADERS OF THE CIVIL WAR

Edited by Ned Bradford

This is the autobiography of the Civil War, told by the men who fought and lived it. The most outstanding portions of the three-volume series compiled into one volume by Ned Bradford.

The outstanding accounts were written by such famous Generals as Lee, Jackson, Grant, Sherman, Longstreet and J. E. B. Stuart. Written while that crucial period was fixed fresh in their minds, their unadorned, straightforward, eye-witness reports make this a military classic. 626 pages, illustrated. $8.95.

PATTON AND HIS THIRD ARMY

By Brig. Gen. Brenton G. Wallace

This is not biography of Patton, but rather a biography of the 3d Army during its astounding blitzkrieg through Europe. Patton is interwoven throughout the narrative which tells how he led the Third to victory, how he baffled the Germans, and how he inspired his men with superb leadership and daring tactics.

Written by an officer who attended Patton's daily staff meetings, it is an authentic history. 232 pages, illustrated. $3.50.

OPERATION OVERLORD

By Dr. Albert Norman

The full story of the 1944 invasion of Western Europe by the Allies under the leadership of Supreme Commander Eisenhower. The author served as historian under General Bradley's Twelfth Army Group. 230 pages, illustrated. $3.75.

THE RED ARMY TODAY

By Col. L. B. Ely

This book offers a description of the Soviet military machine as compiled from authentic sources by an Army officer well versed in the field of military intelligence. (1953). 272 pages, illustrated. $4.00.

AXIS GRAND STRATEGY

By Ladislas Farago

The Nazi "Blueprints for the Total War" translated and made available for an understanding of the nature of the Germans and their planning for and during World War II. (1942). 614 pages. $5.00.

RISKS—THE KEY TO COMBAT INTELLIGENCE

By Col. E. C. Townsend

This outstanding book offers a critical but highly constructive and objective analysis of our present system of producing combat intelligence and offers methods to overcome the deficiencies discussed.

The author uses direct quotations from Generals Eisenhower and Bradley and others to illustrate his point. Mastery of the "basic guides" enunciated in this text will enable one to become better prepared for any combat assignment in any Service. 82 pages (paper cover). $1.50.

NUCLEAR TACTICS, WEAPONS, and FIREPOWER in the PENTOMIC DIVISION, BATTLE GROUP, and COMPANY

By Cols. Mataxis and Goldberg

A detailed "atomic hand-book" compiled from official sources by two instructors at The Infantry School. An invaluable source book that will enable you to become an expert in all phases of atomic warfare. This is a how-to-do-it text designed to help you conduct more effective and realistic training. It provides the details and principles you must employ in tactical exercises plus those required for organization, planning, and executing atomic fires. In no other manual will you find as complete coverage of this vital subject. 300 pages, illustrated. Paper Cover $3.50. Hard bound $4.25.

ARMOR

SEPTEMBER-OCTOBER, 1959 • 80 CENTS

Twenty Years Ago

Armor in the 1939 Polish Campaign

(See Page 4)

Command Decisions

Introduction by Hanson W. Baldwin

Kent R. Greenfield, General Editor

Was General MacArthur right in declaring Manila an open city and retreating to the Bataan peninsula in 1942? Was Hitler's decision to invade Denmark and Norway a military blunder? In retrospect, was General Eisenhower's decision to halt Allied troops at the Elbe River a grave mistake? Was General Lucas right in building up the bridgehead at Anzio rather than driving immediately for the Alban Hills?

In *Command Decisions,* these four and 16 other of the most crucial and controversial decisions of World War II are examined by a selected group of professional historians, and are introduced with a brilliant essay by Hanson W. Baldwin of the *New York Times.*

Unbiased, authentic and thoroughly documented, this collection was inspired by the needs of the United States Army's Command and General Staff School. It was prepared by the Office of the Chief of Military History, U. S. Army. When the project was completed, it became clear that the book should be widely distributed and made available to every citizen. It becomes, therefore, the only volume of the Army's historical series to receive commercial publication.

$5.95

Pickett's Charge

By George R. Stewart

July 3, 1863. 3:00 A.M. After the fighting of the first two days, the dead lie quietly on Oak Ridge and in the Peach Orchard. On the battlefield, in their tens of thousands, the men sleep, or lie resting. Union pickets can hear wagons moving as the Confederates bring up more artillery. The armies of General Robert E. Lee and General George Meade draw breath for a new and decisive encounter. The town nearby is Gettysburg, Pennsylvania, and the next 15 hours will turn the course of world history.

This book is the story of those 15 hours—of the thoughts and preparations, the urgent words and desperate actions of men whose lives suddenly depended on the roll and dip and rise of a mile of Pennsylvania farmland. It is the story, carefully re-created from the mass of records and reminiscences left by both sides, of the untried common soldiers, the war-weary sergeants and the war-intoxicated ones, the teen-age lieutenants, the generals not much older, and the others, veterans of forgotten Indian campaigns who had come again to battle after a lifetime of farming or preaching or keeping store. Out of their individual actions emerges, by a thousand accidents, the larger pattern of the event. Pickett's Charge had been turned. The Battle of Gettysburg was over.

$5.00

The United States Armor Association

(Established 1885)

President
LT. GEN. GEORGE W. READ, JR.
Honorary President
MAJ. GEN. GUY V. HENRY, RET.
Vice Presidents
MAJ. GEN. W. PAUL JOHNSON
MAJ. GEN. DONALD W. MCGOWAN, NG
COL. WILLARD WEBB, USAR
Honorary Vice Presidents
GEN. JACOB L. DEVERS, RET.
GEN. WILLISTON B. PALMER
GEN. WILLARD G. WYMAN, RET.
LT. GEN. EDWARD H. BROOKS, RET.
LT. GEN. CLOVIS E. BYERS, RET.
LT. GEN. JOHN H. COLLIER, RET.
LT. GEN. WILLIS D. CRITTENBERGER, RET.
LT. GEN. HOBART R. GAY, RET.
LT. GEN. ALVAN C. GILLEM, JR., RET.
LT. GEN. GEOFFREY KEYES, RET.
MAJ. GEN. ERNEST N. HARMON, RET.
MAJ. GEN. JOHN C. MACDONALD, RET.
BRIG. GEN. SIDNEY R. HINDS, RET.
BRIG. GEN. WILLARD A. HOLBROOK, RET.
BRIG. GEN. HENRY CABOT LODGE, USAR
BRIG. GEN. PAUL M. ROBINETT, RET.
BRIG. GEN. HARRY H. SEMMES, RET.
Secretary-Treasurer
LT. COL. WILLIAM H. ZIERDT, JR.
Executive Council
GENERAL BRUCE C. CLARKE
LT. GEN. THOMAS L. HARROLD
LT. GEN. ARTHUR TRUDEAU
MAJ. GEN. FREDERIC J. BROWN
MAJ. GEN. HOMER O. EATON, NG
MAJ. GEN. ROBERT E. FRANKLAND, NG
MAJ. GEN. LOUIS V. HIGHTOWER
MAJ. GEN. CLAYTON P. KERR, NG
MAJ. GEN. HARRY W. JOHNSON
MAJ. GEN. SAMUEL L. MYERS
MAJ. GEN. ALMERIN C. O'HARA, NG
MAJ. GEN. JAMES B. QUILL
MAJ. GEN. MAXWELL C. SNYDER, NG
MAJ. GEN. JOHN K. WATERS
MAJ. GEN. EARLE G. WHEELER
MAJ. GEN. EDWARD O. WOLF, NG
BRIG. GEN. CHARLES G. DODGE
BRIG. GEN. JAMES I. KING
BRIG. GEN. HAL C. PATTISON
BRIG. GEN. FRANK HENRY
BRIG. GEN. W. H. S. WRIGHT
COL. BOYD BRANSON
COL. LAWRENCE V. GREENE
COL. DELK ODEN

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR
Lt. Col. William H. Zierdt, Jr.

BUSINESS MANAGER
M Sgt J. William Joseph

ASSISTANT TO THE EDITOR
Sfc Michael E. Kekker

CIRCULATION MANAGER
M Sgt William Coley, Jr.

Volume LXVIII SEPTEMBER-OCTOBER, 1959 No. 5

CONTENTS

LETTERS TO THE EDITOR 2

TWENTY YEARS AGO — Armor in the 1939 Polish Campaign 4
By Richard M. Ogorkiewicz

EDITORIAL 8

MILITARY DIESELS 10
By Major General Nelson M. Lynde, Jr.

ACHILLES' HEEL — A Soldier's Eyes 16
By Robert W. Forsyth and John P. Forsyth

"WHY NOT DIVARMOR?" 18
By Lieutenant Colonel Francis J. Kelly

INDEPENDENT COMMAND 22
By Jac Weller

THE PAPER TIGER OR INTEGRATED DETERRENCE? 25
By Second Lieutenant Thomas E. Carpenter, III

THE TANK GUNNERY QUALIFICATION COURSE 28
By Captains Thomas G. Foster, III and John M. Pickarts

PICTORIAL HISTORY OF ARMOR 42
By Lieutenant Colonel Robert B. Rigg

RECONNOITERING 54

NEW EQUIPMENT: Displayed at the AUSA Meeting 56

FIGHTING HELICOPTERS? — YES 58
By Lieutenant Colonel Albert E. Seifert

ARMY TRAINING TEST — HOWITZER BATTERIES, ARMORED CAVALRY REGIMENT 60
By Lieutenant Colonel Gordon E. McQuain

FIELD MODIFICATIONS: GI Ingenuity in Action 62
By Private First Class Paul Counsell

FROM THESE PAGES 64

ANTITANK MISSILES FOR ARMORED INFANTRY 65
By Lieutenant Colonel John D. Webber, Jr., Major Clifford D. Rhodes, Captain Robert W. Thams and Captain Norman D. DeBord

NEWS NOTES 68

ASSISTING THE FOREIGN STUDENT 70
By Lieutenant Colonel Herschel H. Hutsinpiller

HOW WOULD YOU DO IT? 73
A U. S. Army Armor School Presentation

THE BOOK SECTION 76

ARMS AND THE STATE 76
Reviewed by George Fielding Eliot

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and editorial offices: 1757 K Street, N.W., Washington 6, D. C.

Copyright 1959, by the United States Armor Association.

Second-class postage paid at Washington, D. C. and at Additional Entry. Terms: Domestic subscriptions, including APO's, $4.75—one year and $8.00—two years. Foreign, including Canada & Pan America, $5.50—one year and $10.00—two years.

NEW DEVELOPMENTS

in Army Weapons, Tactics, Organization, and Equipment

By Marvin L. Worley, Jr.

The basic aim of this book is to present within the confines of one volume the condensed picture of not only new weapons, tactics, organization and equipment which have been adopted recently by the U. S. Army but also prototypes, concepts and techniques currently under consideration. This publication represents a digest of Army new developments which are of general interest in the fields of Artillery-Missiles, Armor, Infantry, Airborne-Air Mobility, Nuclear Warfare, Chemical, Engineers, Ordnance, Quartermaster, Signal and Transportation.

The value of a publication of this nature to ROTC, National Guard and USAR personnel, on inactive duty is obvious. However, it is at least of equal value to active duty personnel, since few assignments enable members of the Army to keep abreast of new developments in fields other than their own. This revised edition brings us up to date including the M60 tank.

$3.95

LETTERS TO THE EDITOR

Any Trophies?

Dear Sir:

Recently a former commander of the 1st Squadron 2d Cavalry visited this Headquarters' trophy room. We pointed out to him that the Battalion (the sole heir to his Squadron's record) had trophies dating back only to the late 40's.

The former Squadron commander recalled that in approximately 1941 the Squadron boxed for storage its considerable silver including polo trophies and (much needed) punch bowl.

Unfortunately the Battalion has never located its valuable collection of silver trophies for activities prior to World War II.

We would appreciate your cooperation in publishing a plea for clues to the location of any portion of the Dragoon's tangible record of pre-World War II competitive spirit and *esprit de corps.*

MAJOR JOHN K. BRIER
1st Battalion, 2d ACR
APO 114, New York, New York

• *We will gladly pass on any information or you can contact the writer direct.* ED.

ROTC Awards

Dear Sir:

I, together with my staff, wish to take this opportunity to thank you and your organization for the award which your organization presented at "The Annual Military Review and Awards Ceremony" at Montana State College on 8 June 1959.

The presentation of your award added much to the color and significance of the day. It is through interest of groups like yours that the defenses of the United States are kept strong and alert. The interest and prestige in the ROTC, to which your award has added a great deal, is one of the principal factors in maintaining the quality of the young men entering and serving in the Armed Forces of the United States as commissioned officers. Your generosity and patriotic spirit has made the job of increasing interest in the ROTC program a great deal easier.

CAPTAIN FLOYD M. WILSON
U. S. Army Instructor Group
Montana State College
Bozeman, Montana

• *We hope to make similar presentations in the Spring of 1960.* ED.

In Re General Herr's Book

Dear Sir:

I noticed in the last issue of *ARMOR* that you are trying to locate a copy of General Herr's book *The Story of the U. S. Cavalry.*

If you have not found them by now, I have a copy that I would be happy to send you.

Let me know if you need it. Best wishes.

LT. H. J. BROBST
222 Nogal Drive
Santa Barbara, California

• *We wish to thank Lieutenant Brobst for his kindness in mailing us the above-mentioned book. We are now able to secure this book from the publisher, but we appreciate Lieutenant Brobst's thoughtfulness just as much. Anyone desiring to purchase a copy please contact us. The book is in its third printing. The price is $6 less ten percent which is $5.40 to our members.* ED.

The Draper Trophy

Dear Sir:

In one of your back issues of *ARMOR* you published an article on a Tank platoon trophy which is to be awarded annually to the best tank platoon in Armor. Is it possible for me to obtain a copy of this issue? Also what are

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1959 by the United States Armor Association.

Reprint Rights: All Rights Reserved.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of Armor is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1757 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the even months of the year: i.e., Dec 25 for Jan-Feb issue, Feb 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

the requirements to compete for this award?

MSgt Floyd W. Morton
Company B, 2d ABG, 501st Infantry
82d Airborne Division
Fort Bragg, North Carolina

• *The Draper Trophy, also known as the Armor Leadership Award, is an annual award which is administered by USCONARC personnel through the Draper Trust Fund and Army Regulation 672-73. Each year an Armored Division is designated by the Commanding General, USCONARC to conduct the competition. Last year the 3d Armored was selected. The report of the competition and awards ceremony was covered in the March-April 1959 issue of ARMOR. (See page 31.) This year the 4th Armored was designated. (See page 68, this issue.)* Ed.

Fort Knox National Bank Making Progress

Dear Sir:

The members of the Organizing Committee for the Fort Knox National Bank wish to take this opportunity to express their appreciation for the newsnote which you published in the July-August issue of *ARMOR*.

To date this has been the only publicity outside of Fort Knox concerning the organizing of this bank. The operating bank will be oriented to the peculiar needs of the military and will operate a complete mail system of banking for its customers—world-wide.

To date over $206,000 of stock has been subscribed to of the total capitalization of $500,000.

Anyone interested in receiving the prospectus should send his name and address to the Organizing Committee at the address given below.

Organizing Committee
Fort Knox National Bank
P.O. Box 247
Fort Knox, Kentucky

• *We are happy to see that so much interest has been shown and hope that the publicity in ARMOR has been helpful. It is suggested that unit newspapers in Armored units might desire to publicize this venture as a matter of interest to all Armor personnel.* Ed.

Class III Supply

Dear Sir:

In current warfare, armored columns in advance stages of an exploitation often have been stopped by the lack of fuels; not by enemy action.

The present concept of Class III supply still cannot meet the requirements of 150,000-200,000 gallons per day. The present tanker-dispenser idea will help but cannot dispense fuels it does not have. The present organic transportation cannot deliver the gas.

The answer could be moving the fuel from the ASP by helicopter, using the pick-a-back system of hauling, carrying a detachable 800 gallon tank. This tank would be filled at the ASP; the helicopter would pick it up and fly to the unit where it would set it on the frame of a tanker-dispenser designed to hold two such tanks.

This delivery could be workable day or night as the helicopter could employ a homing device tuned to the frequency of the Armored Battalion. The Battalion could turn on his homing signal when he has an empty tank to be replaced. The plane would pick up the empty, set on a full tank, and return to the ASP.

An H21 type helicopter carrying one tank could haul 8000 gallons per 10-hour day to a point 80 miles from the ASP.

In a normal Armored Division if you assigned organically two helicopters per Armored Battalion, two per Armored Infantry Battalion, two to the Cavalry and two to Trains, the division would have a total of 20 helicopters for Class III supply.

We admit that when operating ten to 15 miles from the ASP on a good road net, trucking would be more economical. However at a greater distance, if you consider the manhours, gas consumed in delivery, delaying factors of bad or nonexistent road nets, the helicopter hauling will best the truck hauling.

Captain Richard H. Loutzenhiser
2626 Pollard Avenue
Lawton, Oklahoma

THE COVER

The pictures for the cover were taken from captured German files. It was in September 1939 that Armor in its mechanized form came into its own as a striking destructive force. Since World War II and with the advent of nuclear warfare Armor continues as a potent member of the combined arms team.

The Joint and Combined Staff Officer's Manual

By Col. J. D. Nicholas, USAF
Col. G. B. Pickett, USA
Capt. W. O. Sears, Jr., USN

This book is designed primarily as a guide for officers assigned to U. S., joint or allied combined commands. It has daily application for all officers.

What has been the background experience of the armed forces in attempting to coordinate their respective plans and actions? What is the new unified command concept? What is involved in joint and combined planning? What is the relationship between national strategy and military strategy? How does a staff officer write and how does he speak? What is expected of an officer assigned to duty with a joint or combined command? What are the qualities of a good staff officer—the qualities that count the most?

The answer to these and other highly important questions are found in this first authoritative book on joint and combined staff duty.

$4.50

ARMOR

in

THE POLISH CAMPAIGN

By RICHARD M. OGORKIEWICZ

THE September 1939 campaign in Poland occupies an important place in military history as the opening of World War II and also in the history of armored warfare because of the major part played in it by armored units. The 1939 Polish campaign provided, in fact, the first practical demonstration of the large-scale mobile employment of Armor and a preview of the decisive results achieved by armored forces in many subsequent operations.

The role of the pioneer in armored warfare was performed in this campaign by the German Panzer forces. Their organization and operations have been ably summarized already by Major Robert M. Kennedy in the D/A Pamphlet on the Polish campaign[1] and in his supplementary article in *ARMOR*.[2] However, neither of these two clear and informative accounts has completed the story by giving an accurate picture of the opposing Armor. Now the 20th anniversary of this significant campaign provides a suitable opportunity for presenting the missing information and several interesting but hitherto little-known facts about Armor before World War II.

Polish Armor

The background to the Polish Ar-

mor of 1939, as that of other contemporary armored forces, extends to the immediate post-World War I period. It was then, in 1918-1919, that the first Polish tank units came into existence.[3] They were organized and equipped by the French and consisted originally of two battalions of Renault F.T. The latter were light infantry-accompanying tanks with which the French Army was then largely equipped and which had also served as a model for the contemporary U. S. M1917 light tank, the basic equipment of the Infantry tank units through the early 30s.

Due to the Renault tanks furnished by their French allies, Polish Armor numerically occupied fourth place in the 20s. The French themselves were at the head of the world list and in 1921 had no less than 3,737 Renault F.T.; the U. S. Army came second with just over 1,000 tanks and the British third. However, by the late 20s the Renault tanks were becoming obsolete and the Poles were faced with the problem of replacement. At the time the lead in the tank field was held by Britain and so the Polish Army went there to obtain its new armored vehicles.

The first to be purchased, in 1928-1929, were about a dozen Carden Loyd Mark VI vehicles.[4] This light, two-man turretless tankette excited a great deal of interest at the time due to its combination of low cost and mechanical performance, and several other countries purchased it from Vickers-Armstrongs. The Italians, for instance, procured 25 and later produced in quantity an improved version of their own, the L/3. The Russians purchased six and later mass-produced a close copy under the T27 designation. In Poland too it was copied, in a modified form, as the TK and TKS reconnaissance tank. Regular production of the TK commenced in 1932 and it was the first tracked armored vehicle manufactured in Poland.

Outstanding Vickers Design

Armed as it was with a single machine gun, the capabilities of the TK and all similar tankettes were extremely limited. In consequence, for a more serious combat role, the Poles purchased in 1932 about 30 of a second Vickers-Armstrongs model. This was the six-ton tank, one of the truly outstanding tank designs which attracted a great deal of attention at the time by its combination of engineering qualities and combat capabilities. Among others, the Soviet Army purchased 15 and subsequently manufactured a close copy under the T26 designation. During the late 30s the T26 became the most numerous Soviet tank and indeed the most numerous tank in the world. It did well in Communist hands during the Spanish Civil War and was still used in large numbers by the Soviet Army when the Germans invaded Russia in 1941.

The Vickers six-ton tank also had an important influence on U. S. tank development, as a result of one being brought over in 1931 for a 30-day evaluation. It is recorded that during the U. S. Ordnance tests its track life reached the remarkable figure of 3,000 miles and several of its features were subsequently incorporated in the T1E4 light tank, which marked a very big step forward in U. S. tank development. How sound this Vickers-Armstrongs design was is further illustrated by the fact that only a few years ago some Vickers six-ton tanks were still operating in Thailand.

The six-ton tank was also remarkable for being developed by Vickers-Armstrongs entirely on their own. The British Army would have nothing to do with it. In striking contrast to the British reputation for sensible compromise, those responsible at the time for British tank development oscillated between the extremes of large, over-complicated tanks which the British Army could not afford and small, cheap vehicles which were of very doubtful combat value. Thus, it was left to private enterprise to evolve a sound compromise—a tank which cost far less than the first category but carried the same caliber gun and whose combat value was far greater than that of the second category. There was a final touch of irony in the fact that although the British Army turned its back on this outstanding product of private enterprise, in 1941 it was glad enough to get U. S. M3 light tanks which were direct descendants of the T1E4 (via the M1 combat car) and indirectly of the Vickers six-ton tank. By 1941 the M3 was no longer the last word in tank design but its mechanical performance was outstanding. It was, therefore, with considerable justification that the British called it "Honey" before it was redesignated "Stuart" after the great Virginia cavalry leader.

To return to the Polish case, the purchase and experiments with the Vickers six-ton tanks were followed by a decision to manufacture a similar tank in Poland. The Polish 7TP model was, however, an improvement on the Vickers original: it was armed with a high velocity 37mm gun in place of the original low-velocity 47mm and it was powered by a Swiss-designed Saurer diesel. The 7TP was, in fact, one of the earliest if not the first diesel-engined tank to come into regular service. Its armor thickness was also increased so that it weighed almost 11 short tons.

Production of the 7TP began in 1935 and by September 1939 just over 100 had been made. More could have been produced but for pettifogging arguments over increases in its armor thickness which interrupted production for a time—a typical example of the senseless perfectionism into which ordnance development is apt to relapse in peacetime and which the Russians best managed to avoid, to their great advantage.

Christie Tanks

For all their purchases of tanks from

RICHARD M. OGORKIEWICZ, well known to readers of ARMOR and a frequent contributor to many professional military magazines, suggested this article for this issue in commemoration of the twentieth anniversary of the first campaign of World War II. Highlighting the role of Armor in this significant campaign, it served as a forerunner of the impact of the mobile arm on all theaters of operations for the entire war.

Britain, the Poles were also alive to new developments in the United States, where another outstanding design appeared in 1928. This was Walter J. Christie's tank which had a suspension system and speed well in advance of any other contemporary tank. As a result of the remarkable performance of his 1928 experimental model new tanks were ordered from Christie by the Polish authorities in common with the U. S. Army and Soviet agencies. However, the first failed to take delivery of its vehicles and the two Polish-ordered tanks were taken over by the U. S. Army, swelling its total to seven: of these, three were given to the Infantry as T3 medium tanks and the other four, including the two Polish vehicles, went to the Cavalry as T1 combat cars. In contrast to the Poles, the Russians collected the two tanks they ordered and soon began mass-production of their own B.T. version. From the latter came the T34 medium tank of World War II fame, the T34/85 of the Korean war, and by further evolution, the current 100-mm gun T54.

It is of interest to note that the current British Centurion can also trace its ancestry, through the "cruiser" tanks of World War II, to Christie. However, it was only in 1936 that a Christie vehicle was purchased by British authorities, as a result of a military visit to Russia where the virtues of Christie's ideas were discovered in Soviet B.T. tanks. The discovery has been described in several books, including those of General Martel[5] who was the tank member of the British mission to Russia in 1936, and unintentionally makes amusing reading in view of the fact that it took place eight years after Christie's original vehicle appeared in Elizabeth, New Jersey.

As for Poland, in spite of the failure to procure the two tanks in 1931, interest in Christie tanks did not die out. In fact, the Polish Army started to design a 12-ton Christie-type fast tank of its own. It was envisaged for the mechanized cavalry brigades but its development had not been completed when the war began. For other tanks the Polish Army turned once more to France. With the help of a French military loan granted in 1936 it ordered a number of thickly-armored R35 French infantry support tanks of which, however, only enough had been delivered by September 1939 for one tank battalion.

Relative Strength and Employment

The various attempts to bring Polish armored equipment up to date met with partial success but numerically Polish Armor definitely lost the position it held after World War I. On the eve of World War II first place was occupied by the Soviet Army with more than 10,000 tanks. The Germans came second, followed by the French and the Japanese who from 1931 through 1939 produced a total of 2,030 tanks; fifth came the Italians and sixth the British with 1,148 tanks. Poland was now well down the list, in seventh place, and the United States eighth.

On September 1, 1939 the German Army actually possessed a total of 3,195 tanks, as already recorded by Major Kennedy. This total did not include Czech tanks which had been taken over by the Germans but which had not been integrated yet into the German organization. Of the German total about 2,000 were actually deployed against Poland. To oppose them the Polish Army had 140 7TP and Vickers tanks, 45 R35 and about 500 TK and TKS tankettes. The German numerical superiority was therefore overwhelming. The Germans were equally superior in the employment of their tanks which were concentrated in Panzer divisions whereas Polish Armor was dispersed in small units.

The Polish Armor was organized into 33 tankette companies, two Vickers six-ton tank companies and two 7TP and one R35 battalions; there were also 11 armored car troops, 10 armored trains and three companies of old Renault F.T. Of the first category 18 tankette companies were attached, one each, to infantry divisions and 11, together with the armored cars, went to a like number of cavalry brigades for reconnaissance purposes. The three tank battalions were held in reserve, at the disposal of higher commands, and spent most of their time being moved about, wearing out their equipment to little purpose.

Only one Vickers and two tankette companies were attached to each of the two Polish mechanized cavalry brigades, which could have made far better use of some of the other tanks. In view of the overall German superiority the outcome of the campaign could not have been different but Polish Armor could have given a better account of itself if it had not been used piecemeal. The employment of Polish Armor in 1939 was,

Polish 7TP Tanks.

TKS Reconnaissance Tankettes.

in fact, a striking example of the inept methods which prevailed before World War II and which were repeated on a far larger scale a year later, with equally disastrous results for French Armor. In both the Polish and French cases the capabilities of Armor failed to be exploited and both provide a clear warning of the consequences of the slow-motion piecemeal methods in face of effective hostile armored forces which make full use of their mobility.

Horse Cavalry

Dealing with the 1939 campaign in Poland it is impossible not to refer to Armor's predecessor, the Cavalry, if only because of the amount of nonsense which has been written about Polish Cavalry. The common but totally erroneous view is that the Polish Army maintained an unusually large force of horse cavalry, which was archaically equipped and which dashed itself to pieces in fantastic charges with sword and lance. Even such sound writers as Colonel Ely[6] and Raymond Garthoff[7] have swallowed the fable about cavalry charges against German tanks!

The facts relating to Polish Cavalry have been set out in detail by the writer in another article, which is being published concurrently elsewhere[8], and only the main points need be mentioned here.

First, the numerical strength. There were 11 horse cavalry brigades with a total of 37 cavalry regiments. This, in relation to the rest of the Polish Army, was not materially different from the proportion of Cavalry maintained during the 30s by other armies, such as the British, Soviet, etc.

Secondly the equipment. It consisted of the well-known 7.92mm Mauser carbine, Polish-made 7.92mm versions of the familiar B.A.R. and of the Browning water-cooled heavy machine gun, Polish-designed antitank rifles and 37mm Bofors antitank guns. So far as antitank weapons were concerned Polish cavalry regiments were, in fact, as well armed as any contemporary units of their size. The only discordant note among this up-to-date equipment was struck by the fact that in several regiments a portion of the troopers were still encumbered with lances—a relic of the cult of the *arme blanche* which was paralleled in other armies by the emphasis on the bayonet.

Finally the charges. There were precisely two, both against German Infantry. The first, delivered on the first day of World War II by two cavalry troops, was initially successful but came under heavy flanking fire which inflicted heavy losses. The only other cavalry charge of any significance was delivered on September 22, and was successful in breaking through an infantry cordon. There may have been an excuse in the past for some of the nonsense written about Cavalry in the 1939 campaign based on the inadequate information on the subject but there is none now for military historians since the actions of all the cavalry units concerned have been described in great detail in the monumental series of volumes being published by the Sikorski Historical Institute in London, England.[9]

Exceptions apart, the employment of Cavalry in Poland consisted of series of dismounted delaying actions. The cavalry brigades shared the inevitable defeat of the Polish Army but on the whole they did better than the infantry formations on account of their mobility. The relative advantages of horse-mobility were diminishing rapidly with the development of mechanization but Cavalry still enjoyed its benefits in relation to the slower Infantry. In fact, when the odds were not as heavily loaded against it as they were in Poland in 1939, horse Cavalry could still play a very useful role in warfare. This was clearly shown later by Soviet Cavalry, which rose to a peak of about 35 divisions in 1942, and by the Cavalry of the German *Waffen*-SS. Thus, even in its twilight, horse Cavalry retained an advantage in its mobility and this forms a clear link between it and Armor which carries on the great cavalry tradition of mobile warfare.

---

[1] Kennedy, Major Robert M., "The German Campaign in Poland (1939)," Department of the Army Pamphlet No. 20-255, 1956.

[2] Kennedy, Major Robert M., "The German use of Armor in Poland," *ARMOR*, Vol. LXVI, No. 1, Jan.-Feb., 1957.

[3] Ogorkiewicz, R. M., "The Story of an Armoured Force," *Royal Armoured Corps Journal*, Vol. VI, No. 3, July 1952.

[4] Bahrynowski, Lt. Col. S., "Polska Bron Pancerna" (Polish Armored Force), *Bellona*, July-Sept. 1955.

[5] Martel, Lt. Gen. Sir G.le. Q., *Our Armoured Forces*, Faber and Faber, London, 1945.

[6] Ely, Col. Louis B., *The Red Army Today*, Military Service Publishing Co., Harrisburg, Pa., 1949, p. 75.

[7] Garthoff, Raymond L., *Soviet Military Doctrine*, Free Press, Glencoe, Ill., 1953, p. 316.

[8] Ogorkiewicz, R. M., "Polish Cavalry in 1939," *Royal Armoured Corps Journal*, Vol. XIII, No. 8, October 1959.

[9] "Polskie Sily Zbrojne w Drugiej Wojnie Swiatowej" (Polish Forces in World War II), Sikorski Historical Institute, London, 1951 onward.

Editorial

These parting remarks by General Carter B. Magruder to the senior members of his staff and the Chiefs of the Technical Services, upon his departure as DCS for Logistics, D/A to assume command of the United Nations Command and Eighth U. S. Army, are a challenge to all of us to prepare for the future. The emphasis he places on Armor's role on the future battlefield is indeed significant.

I CHOOSE to say my few parting words about our Army, the Army to which we have devoted our lives and which we love. The Army has much to do to establish its decisive role in nuclear war. It must enhance its capabilities. Why, after General Taylor has made such a good case for the Army in limited war, do I now suggest that the Army's capabilities can and should be expanded to make it a decisive force in any nuclear war? The answer is that the weapons heretofore considered to be decisive in nuclear war are being rendered less dominant. I believe that our surface-to-air capability will eventually render the manned bomber obsolete. Our rapidly advancing development of the anti-missile missile bears promise of rendering the intercontinental ballistic threat less serious.

At the same time the Army's capability to operate effectively in nuclear war is being increased as we progress with our modernization program. I shall expand on the direction in which I feel we should advance in order to make the Army capable of moving into the heart of an enemy's territory and compelling a decision.

For the soldier to live on the atomic battlefield of the future, there exist two means of protection which make his possibilities of survival greater: entrenchment and Armor. If he digs in or takes shelter in protected covering, he secures a good degree of protection against an atomic burst but he loses his mobility. So I rule out this as a means pointed toward a decision. A second method is to employ more Armor. It may well be that only Armor can move on the atomic battlefield. Armor has very definite protective capabilities on the nuclear battlefield. It is presently able to withstand tremendous heat and blast effects and offers considerable protection against radiation. This capability within the Army arsenal at this time appears to present the best field for development of that Army decisive offensive capability which I seek. It therefore appears we should armor the unarmored elements of our armored divisions. Also we should armor our infantry divisions, perhaps less heavily, but just as completely. While maintaining protection against conventional weapons, we must strive continually to increase and improve the protection our armor gives against the heat, flash, blast and radiation from nuclear bursts as well as its firepower, mobility and staying quality.

The major scientific advances that are required to place it within our power to do these things have been accomplished except one, which now shows promise. The development required is to increase the protection of the crews of armored vehicles against radiation. No type of armor that we have been able to develop within reasonable weight limitations has offered a degree of protection against radiation that our armored vehicles now offer against blast and heat. The Medical Corps now has under development, medicines that promise to increase the resistance of the human body to the effects of radiation. This becomes a development of the most critical importance.

I would diverge a moment to say that most of you have heard much of what I am saying, from me, before. I have presented my ideas to the Army War College on numerous occasions to subject them to the close scrutiny of young men who have no inhibitions about

asking questions, and have been asked no questions that I could not answer at least to my own satisfaction. I have posed this theory to the Infantry School at Fort Benning. I have the impression that the Infantry School feels the Infantry should have more armor, particularly light armor but they feel that we cannot afford this much armor.

Having once established the premise that Armor promises our greatest future capability, what must we do further to make our armored Army capable of effecting decisions in the nuclear war? The answer is to increase mobility. In nuclear war an armored force supported by nuclear weapons can break through an enemy position but an unarmored line of communications can hardly be maintained through such a penetration. The essence of mobility therefore becomes the ability to move and fight and move again and fight again without resupply.

When our troops executed landing operations in World War II, it was found that they could go for days with only food, ammunition and POL. We must lighten our requirements for these items so that an armored unit can carry within its vehicles supplies to last it several days. We must develop armored vehicles that have an atomic firepower capability. We will never be able to operate freely for long periods of time on the atomic battlefield burdened down with heavy loads of conventional ammunition. We must, therefore, have atomic ammunition which is small and light, yet can pack the punch needed.

We must develop an atomic-powered engine for our armored vehicles for the same reason. It will be impossible to resupply our armored vehicles with the tremendous amounts of fuel required to go the great distances involved. We must be able to go as far as possible on the most limited weight of fuel and power pack combined.

If the men who operate these combat vehicles are to survive on the atomic battlefield, they cannot dismount therefrom without risking that they will be destroyed while unprotected. We must, therefore, provide means for these crewmen to live within their vehicles for indefinite periods of time. I think we also need an air intake that filters out toxic gases and radioactive dust.

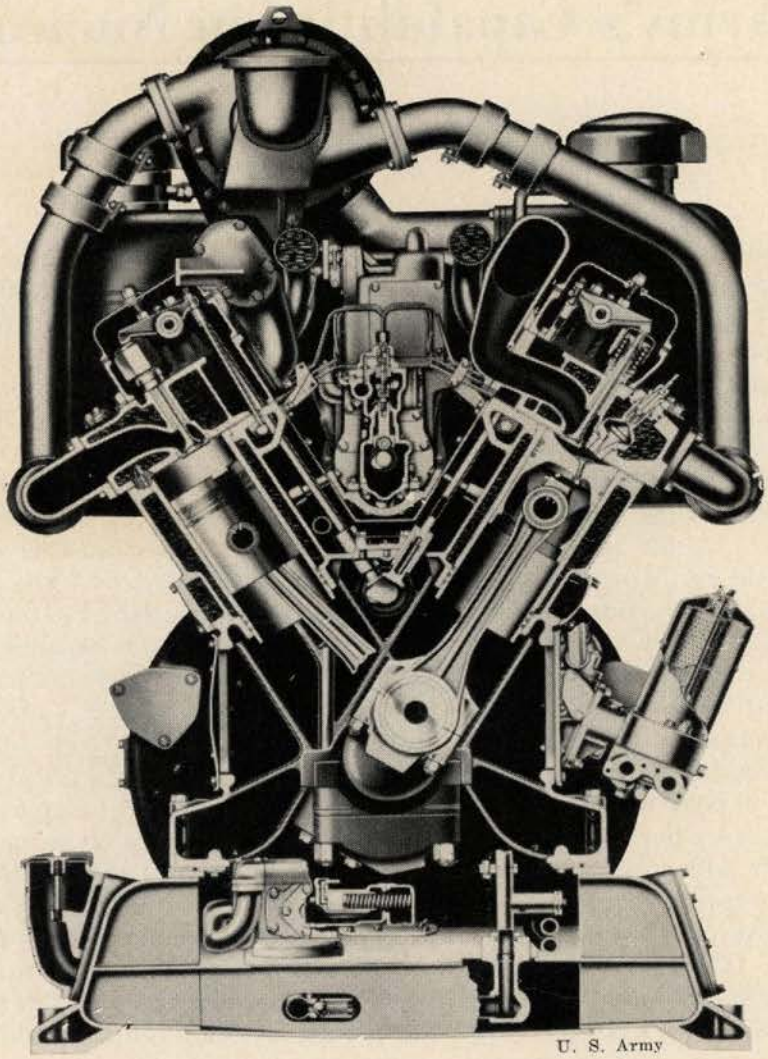
For these men to live in their combat vehicles and to cover the distances which I envisage, requires they must have an adequate quantity of food; and this requires food without refrigeration. To this end, we already have within our capabilities the means of supplying dehydrated and irradiated foods sufficiently small in bulk, sufficiently high in food content, to last a crew for considerable periods without overburdening the capacity of whatever vehicle is being used.

Of course, to make these long thrusts into enemy territory and remain there, precludes the possibility of bringing up vast quantities of repair and maintenance facilities now common to armored formations. We must make these armored vehicles so sturdy and reliable that they can do without this maintenance support.

Only through such means as I have discussed does it appear that we can provide the Army with that capability to breach the enemy defensive line, to thrust deep into his homeland, to destroy his forces and force a decision. To achieve the mobility, the range without resupply, that I would seek, I would sacrifice in armored vehicles a high degree of speed; I would sacrifice power; I would sacrifice to a degree cross-country mobility; I would sacrifice a high degree of maneuverability. Given the atomic punch, and the range, other things become secondary.

These, gentlemen, are some of the tasks which I feel lie before us, tasks which have as their goal the establishment in the Army of a decisive capability in nuclear war. I shall watch your efforts from a very great distance but with keen interest.

MILITARY DIESELS



U. S. Army

By MAJOR GENERAL NELSON M. LYNDE, JR.

SMASHING through to the Germans' rear, Montgomery's mechanized forces sped across the desert in an attempt to bottle up Rommel's troops during World War II. But the drive ground to a halt short of its goal—stopped not by the German might, but by the inefficiencies of the gasoline engines powering the thrust. Some 50 miles more operating range was needed; instead, days were added to the battle of El Alamein.

In the ensuing years, determined to provide that extra range, Ordnance Tank-Automotive Command, OTAC, placed into effect a program for developing and testing diesel engines for its entire fleet of armored vehicles. In addition to gaining more operating hours per tank of fuel, OTAC is realizing extra benefits in greater power, increased hill climbing ability and reduced servicing and logistical requirements.

Diesel engines are not new to the Armed Forces. They were used extensively in World War II and the Korean action. They have provided dependable power from the Arctic to the Antarctic, from steaming jungles to lofty mountain tops. Much of this experience has been under combat or adverse climatic conditions.

The Germans learned to fear "The Whispering Death"—the reverberating throb of the diesel-powered M10 Tank Destroyer, a sound which could not be pinpointed, but which brought with it the smashing deadly blows from the M10's 3-inch gun. The 634th Tank Destroyer Battalion fought throughout the European campaign with the 1st Infantry Division. Only 18 of its vehicles were lost through enemy action, while one companion outfit was re-equipped three times with gas-powered equipment.

On Normandy's Omaha Beach, D-Day, 1944, a diesel-powered tractor worked 24 hours a day to help open the way for landing operations. The tractor pulled wheeled and tracked vehicles out of the surf, while it was the specific target for intense mortar and artillery fire. Then the two operators—Privates William J. Shoemaker and Vinton W. Dove—cleared obstacles from the beach exits. They smashed road blocks and filled antitank traps. Both operators received the Distinguished Service Cross for "Their courageous actions permitting vehicles and Armor to move out in support of the infantry troops." In 1200 hours of service, the tractor was

in the shops for maintenance only once. During the Battle of the Bulge, a 60mm shell smashed into the tractor, severely wounding Dove.

During World War II, several thousand diesel-powered M4A2 tanks were produced, and about half received combat service by the United States and her allies. More than 51,000,000 horsepower was supplied by diesel engines for Navy craft. Much other dieselized equipment was used by all the services during this period.

Recently, diesel-powered tractors and electric generator sets have provided prime power for defense and scientific programs in both polar regions. DEW Line—the network of radar stations across the Arctic Circle—was pioneered with trains pulled by diesel-powered tractors. One tractor-train traveled 600 miles in 17 days, establishing seven stations along the route. Despite minus 20 degree temperatures, up to 375 hours were placed on the engines with just three shutdowns—for servicing only.

So around the world, for war and science, the military has come to rely on dependable, economical diesel power. In future conflicts the Armored Division is expected to pack one of the Army's best punches. This combination of tanks, armored cavalry, Infantry, Engineers, and Artillery must be able to move quickly, for long distances, and with a minimum of supply lines.

These requirements can best be met with the compression ignition diesel engine. Fuel is ignited by heat generated by the 16 to 1 compression of air in the cylinder into which the fuel is injected, instead of by an electrical system. The fuel system, matching military requirements for dependability and serviceability, includes precalibrated fuel pumps and injectors for each cylinder. Pumps and injectors are interchangeable between

(U. S. Army)

The M4A2 diesel powered tank used in World War II.

cylinders, need no adjustment in the field, and are as easily installed as a spark plug.

Precombustion chambers in each cylinder precondition the fuel, provide excellent response at all speeds, and permit burning a wide variety of fuels. Heavy fuels, such as low grade furnace oils, can be burned as readily as light fuels, including gasoline mixed with lubricating oil. A foraging tank could replenish its supply from local fuels and continue on its mission.

Diesel engines operate on high compression of a large volume of air. As a result, the amount of fuel injected or the ratio of fuel to air can be varied widely to match load requirements. From idle to full load, the diesel engine has better efficiency than gasoline engines—diesel efficiency is about 40% compared to 25% for gasoline. Coupled with more heat content per gallon of diesel fuel than gasoline, the diesel engine delivers more horsepower per gallon and almost twice the operating range per full tank.

Ruggedness and durability are other marks of diesel design. In crawler tractors the engine must operate smoothly despite shock loads imposed by sudden changes in load on the machine and by operating over rough terrain. These engines normally operate thousands of hours without major repairs.

Diesel engines have excellent lugging power—power to speed up steep inclines, power to negotiate extra rough spots without stalling, power to permit rapid maneuvering over all types of terrain without becoming a sitting duck. A large volume of air in the cylinders permit additional fuel to be injected as soon as the engine begins to lug down under load, providing an extra surge of power when needed most.

Diesel fuel is safer than gasoline. Direct hits in the engine compartment of a diesel-powered tank will not cause a disastrous explosion of fuel, as with gasoline. And a diesel-powered tank that rolls over on a steep incline can be righted and sent on its way—gasoline-powered tanks frequently catch fire. Accumulations of gasoline in the hull from leakage in the fuel system often lead to explosion—with diesel, this is not a hazard to be faced.

In addition, the absence of a spark ignition system for combustion eliminates the need for the expensive shielding of the engine to prevent radio interference.

In many respects, the diesel engine is like a gasoline engine. Both have cylinders, pistons, crankshafts, valves—all in the same relative positions. The major differences arise in the method of igniting the fuel. But these differences provide the many advantages of diesel power.

Basically, the major difference between the two types is the methods of fuel ignition—compression ignition in the diesel, spark ignition in the

MAJOR GENERAL NELSON M. LYNDE, JR., a 1929 USMA graduate, was commissioned in the Infantry. During World War II he was the Ordnance Officer for 15th Army in Europe. In the early 1950's he was the Theater Ordnance Officer in the Far East responsible for logistical support, rebuild of Ordnance equipment and supplying ammunition for ROK forces and other Military Aid Program countries. He was the Commanding General of the Ordnance Tank Automotive Command since 1955. This past Summer he was assigned as Chief, Field Service Division in the Office of the Chief of Ordnance, Department of the Army. This article is being simultaneously published in the *Army Information Digest.*

(U. S. Army)

Diesel powered tractors pioneered the DEW Line.

gasoline. At about 12:1 compression ratio (the relationship between the space in the cylinder with the piston in its lowest position and the space at its highest position), the temperature of the compressed air is high enough to ignite most petroleum products used as fuel. Compression ratios of diesel engines run about 16:1. This permits the diesel engine to use the heat of compression to ignite the fuel —the principle of compression ignition. This eliminates the complicated, troublesome electrical system of spark ignition engines, which use an electric spark in the cylinder to ignite the fuel. Because of greater expansion of the burning gases in the higher compression engines and more heat content of the fuel, the diesel engine is about 40 percent more efficient than the gasoline engine.

Since the diesel fuel is ignited by compression, it must be admitted to the cylinder differently than in a spark ignition engine. First, it is necessary to understand the four-stroke cycle common to both types of engines:

1. Intake—air or an air and fuel mixture is drawn into the cylinder on the downward piston stroke.

2. Compression—the air or mixture is compressed by the rising piston.

3. Power—the fuel is ignited and the expanding gases of combustion force piston downward.

4. Exhaust—burned gases are cleared from the cylinder by the rising piston.

In the gasoline engine, lower compression ratios permit the air and fuel mixture to be fed into the cylinder during the intake stroke. A throttled quantity of air mixes with a metered amount of fuel in the induction system before entering the cylinder.

Only air is drawn, or packed by a supercharger, into the cylinder of a diesel engine during the intake stroke. The air is compressed by the rising piston; its temperature rises to about 1100° (F). Fuel is sprayed into the chamber slightly before the piston reaches its topmost position and is ignited by the intense heat.

All diesel fuel injection systems provide basically the same functions —a fuel supply, a transfer pump, filters, high pressure pumps, timing, metering and injection. Variations occur mainly in the methods of timing, metering and injection. The system discussed has been proved under demanding earth moving conditions performed by crawler tractors, high-speed hauling units and precision motor graders.

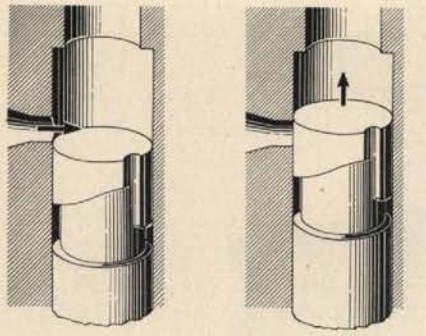
Several measures are available to help provide clean fuel. First, operators should use only clean fuel. Most foreign particles will settle out if the fuel is allowed to stand for at least 24 hours. As the fuel enters the tank, larger particles are caught by a screen inside the filler opening. Fine particles are removed by resin-impregnated cellulose filters before the fuel enters the injection pumps.

Fuel is delivered from the fuel tank to the filters at about 15 PSI by a gear-type transfer pump. Flow rate increases as the engine RPM rises, but pressure is maintained at about the 15 PSI level by a pressure relief valve in the filter housing. Excess flow is returned to the tank.

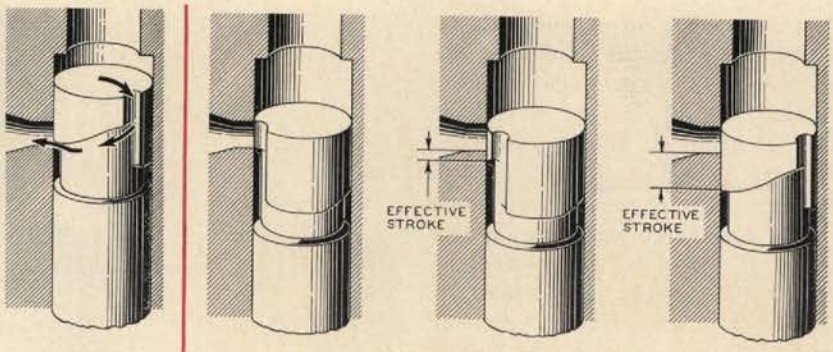
The amount of fuel injected into the cylinders is varied by the governor. The throttle imposes a spring load on the governor, controlling the desired RPM of the engine. The spring load causes more fuel to be injected into the cylinders. This action is countered in the governor by a linkage with flyweights, spun by a gear train from the crankshaft. As the engine RPM increases, centrifugal force causes the flyweights to exert more force and reduce the rate of fuel injection until the two actions balance one another. If the engine is slowed by load, such as when a tank starts up a steep hill, the flyweights slow down and the spring increases the injection rate. More fuel per piston stroke increases power, returning the engine to desired RPM. At full speed the governor controls engine speed to within 10 percent of full load RPM.

An individual injection pump delivers carefully measured quantities of fuel, at the proper instant, to each cylinder. In diesels operating at about 2000 RPM, this injection period may last only about three thousandths of a second. Pumps are actuated and timed by a camshaft, geared to the crankshaft. They are mounted in line, geared to a rack controlled by the governor.

The injection pump consists of a machined plunger inside a drilled housing. A helical groove is cut around the plunger near its top, connected to the top of the plunger by a narrow vertical slot. The bottom of the groove is cut straight around the plunger. The top is cut upward in a clockwise direction, providing a narrow groove on the right side of the vertical slot that widens as it cuts around to the other side of the slot. Fuel enters the plunger barrel through an inlet port drilled in the side of the barrel and is pumped to



The injection pump.



The pump in operation.

the cylinder through high-pressure tubing from the top of the barrel.

In operation, fuel flows into the barrel above the plunger at about 15 PSI from the fuel manifold. As the plunger is lifted by its cam, the inlet port is closed by the solid section of the plunger. Fuel trapped in the barrel is forced on to the injector at about 1500 PSI, sufficient to overcome the maximum pressure in the cylinder at the time of injection. Injection ends when the plunger rises high enough for the top of the groove to uncover the inlet port, permitting the fuel to return to the manifold. The length of injection, and consequently the amount of fuel injected, is determined by the distance from the top of the plunger to the top of the groove opposite the inlet port.

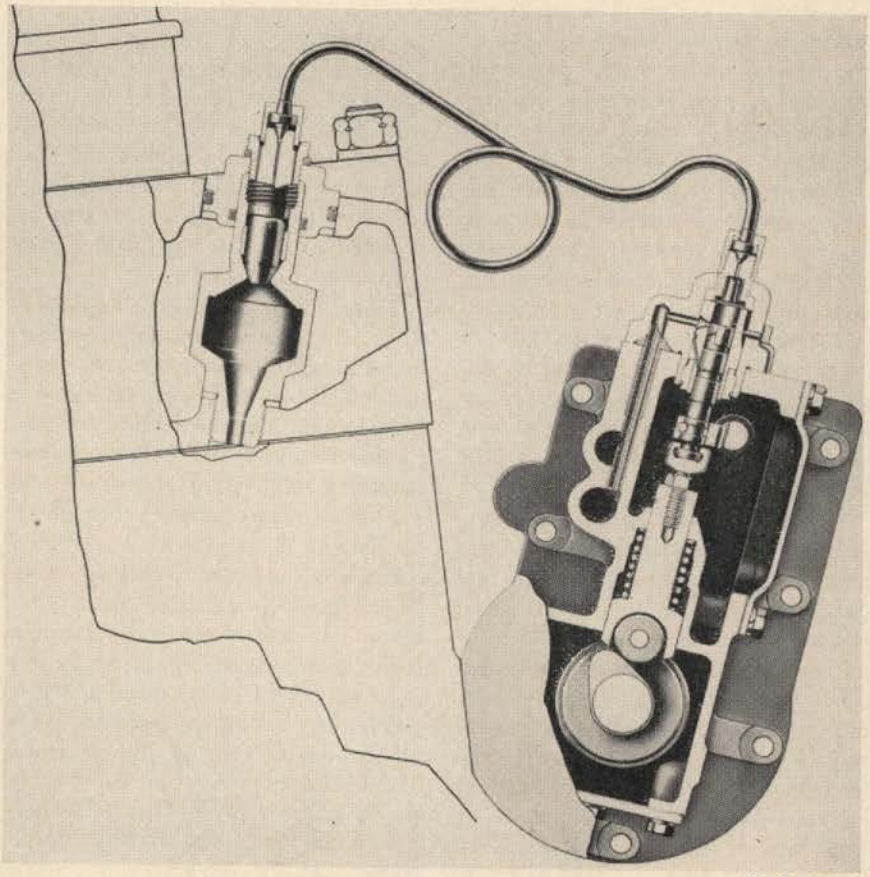
High pressure fuel is sprayed into the precombustion chamber by a simple injector. A spring-loaded valve in the injector is lifted when the fuel pressure exceeds about 750 PSI and closes automatically when the pump ends its effective stroke. This snap closing prevents dribbling of fuel into the precombustion chamber, and a resultant carbon build up. It lengthens service life and full power operation of the engine.

The precombustion chamber is a small compartment between the injector and the cylinder with a narrow passage into the cylinder. As the piston rises on its compression stroke, air in the precombustion chamber is compressed, its temperature jumping to about 1100° (F)—equal to that in the main combustion chamber. As the fuel is injected into this small chamber, about 10 percent bursts into flame, causing a rapid pressure rise inside the chamber. The remainder of the fuel is forced out through the small passage, atomizing and mixing with the air in the main combustion chamber for efficient burning. This system permits heavy fuels, rich in heat content, to be burned as readily as light fuels, with no changes in components of the system.

Diesel engines have a tremendous appetite for air. This appetite has been increased by the adoption of turbosupercharging to pack more air into each cylinder, permitting burning of more fuel on each stroke for greater power from the same size engine. An efficient manifolding and cleaning system has been developed to aid in filling this need.

Military vehicles face the same problems of air supply as confront construction machines. *First,* the air frequently contains large quantities of dust. If the dust is not removed, it will cause excessive wear and subsequent failure. *Second,* air cleaners must be compact, rugged and easily serviceable. *Third,* the engines must be able to perform satisfactorily from sea level to mountain tops. Each of these conditions has been met by the modern diesel engine.

Before delving into these specific points, here is a look at the com-



(U. S. Army)

The fuel injector system.

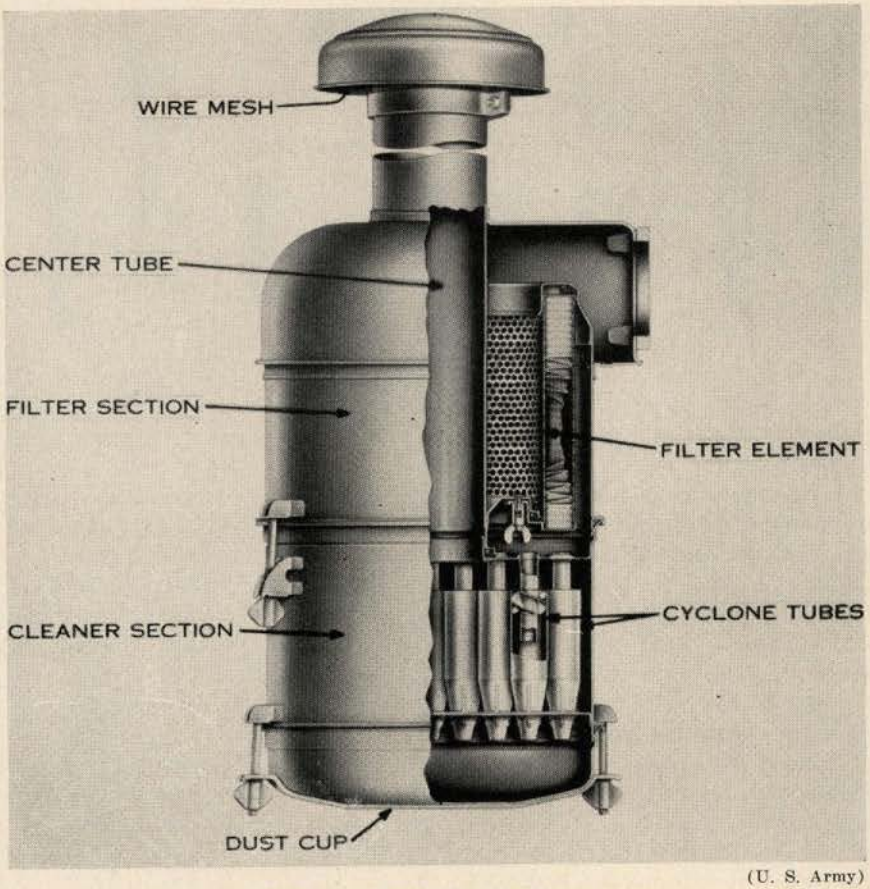
plete air system. Air at ambient temperature and pressure enters the system through the inlet pipe. It passes through an air cleaner, where the dust is removed. If a turbosupercharger is used, clean air is pulled from the cleaner through the compressor side of the turbosupercharger and is packed into the inlet manifold. High pressure air is then distributed to each cylinder, entering on the suction stroke of the piston. The air is then compressed to about 600 PSI and 1100° (F), mixing and burning with the injected fuel to produce power.

Burned gases are discharged from the cylinder into the exhaust manifold on the exhaust stroke. The hot gases are vented to the atmosphere through the turbine side of the turbosupercharger, using otherwise lost power to spin the turbine and directly connected compressor.

This system provides a relatively constant amount of air per stroke, regardless of the amount of fuel injected. It supplies about 20 pounds of air per pound of fuel at normal full load conditions. At least 17 pounds of air per pound of fuel is necessary for complete combustion. This excess of air permits additional fuel to be burned when the engine lugs down under load, providing, for example, that extra surge to carry a tank through a soft spot or over the top of a steep hill.

A new dry type air cleaner has been developed recently for tractor engines which removed 99.8 percent of all dirt from the diesel's intake air, even under the dustiest conditions. It contains a center intake tube, a multicyclone precleaner, and a disposable resin-impregnated cellulose filter, mounted in a sturdy housing with a dust collecting tray in the bottom.

Requirements for compactness, ruggedness and serviceability are also met by this cleaner. It is small and completely self-contained. It has been designed to meet rough earth moving conditions, to withstand continued shock loads without malfunction. Under most conditions, the collection tray is emptied daily. The dry type filter element usually is cleaned at engine oil change periods by a reverse flow of water or compressed air and normally may be cleaned up to six times before replacement.



(U. S. Army)

The new dry type air cleaner.

This air system normally is set for operation at sea level and will provide sufficient air for operation up to 2500 feet with no appreciable loss in horsepower. The turbosupercharger added to the fuel system can be adjusted to provide adequate power output up to 16,000 feet.

Temperature control is a major factor in the proper performance of an internal combustion engine. Continued efficiency and adequate service life depend on the ability of the cooling system to maintain even temperatures, well within maximum and minimum temperatures, throughout the engine.

Cooling can be accomplished either by using a liquid coolant or directly by air. In either case, the purpose is the same—the system must remove the excess heat of combustion while preventing undue stress and wear in the engine. In the liquid-cooled diesel engine, the coolant must carry off 25 percent of the heat (35 percent is converted into flywheel horsepower and the remainder is ejected through exhaust).

It is well recognized that excessively high temperatures must be avoided. The cooling system must prevent breakdown, due to overheating, of the lubrication film separating rubbing surfaces. Overheating causes the oil to lose its strength, permitting rapid wear and premature failure of working parts. The most favorable temperature is below 220° (F). At this point, the oil can adequately perform its cooling and lubrication tasks while providing adequate oil life between changes.

In addition, the system must prevent loss of strength due to overheating of the metal. Many engine components have been hardened to resist wear. Excessively high temperatures can destroy this hardness, permitting rapid wear even when the engine later is operated at normal temperatures. Overheating also increases metal fatigue, reducing its normal life expectancy.

The cooling system also must prevent excessive strain in or between parts due to unequal temperatures within the engine. Hot spots can

cause metal to crack, parts to break.

Equally important, though not so well understood, are the detrimental effects of low engine temperatures. When engine temperatures fall below 160° (F), the excessively low temperatures permit water vapor formed by combustion to form on the cylinder walls and combine with any sulphur in the oil to form sulphuric acid. This compound accelerates wear of rings and liners and destroys the additives in the lubrication oil which normally help keep the engine clean.

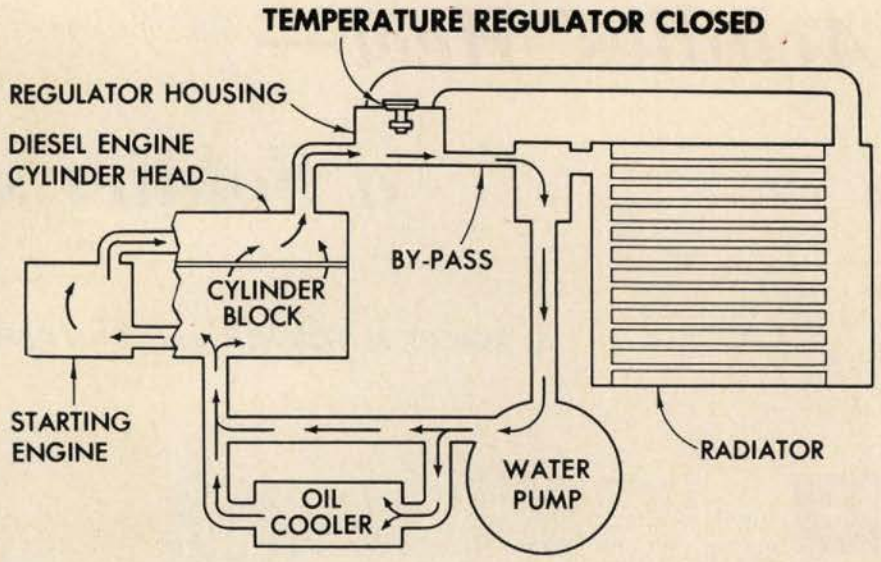
Either air or liquid cooling can do a good job of cooling oil, including torque converter and transmission fluids, consuming about the same horsepower. But air cooling must use considerably more horsepower, particularly under severe conditions, to properly control temperatures of cylinder walls.

In a liquid-cooled system, the temperature of the coolant can be thermostatically controlled within a predetermined range to maintain desired engine temperatures. The liquid coolant—normally water—can be directed around the cylinders and to problem areas to eliminate hot spots and maintain equal temperatures on parts throughout the engine. The liquid also can be directed through heat exchangers to cool torque converter and transmission fluids and gear lubricants.

Engine weight can be about the same for either air-cooled or liquid-cooled systems. Each cylinder of an air-cooled engine is surrounded by metal fins to help dissipate the heat. The cylinders must be far enough apart and the fins of sufficient size to provide adequate cooling. The liquid-cooled engine can be more compact, reinforced by the metal water jacket surrounding the cylinders. Either system will suffer equally from shell hits.

For cold weather operations, the water in a liquid-cooled system should include anti-freeze solution to prevent freezing. Rust inhibitors should be used year around to prevent accumulations on cooling surfaces.

Methods of starting do not differ greatly between gasoline and diesel engines, although on the surface they would appear to. In both instances, it is necessary to crank the engine until the air and fuel is compressed and ignited, permitting the engine to run under its own power. An electric starter motor can start the diesel adequately at far below freezing temperatures by using a glow plug in the precombustion chamber (a glow plug is a metal rod, or resistance unit, heated electrically, which raises the temperature in the chamber sufficiently to help ignite the fuel), direct electric starting can be accomplished at temperatures well below zero.



The temperature regulator.

Maintenance on a diesel engine is relatively simple. Only lubricating oil and filters need be serviced during several thousand hours. Compression ignition eliminates the electrical system otherwise required to provide a spark in each cylinder at the proper time.

Due to use of hardened alloy steels and precision manufacture of the components, the fuel system provides a long, trouble free life. Plungers and barrels of the injection pumps are machined to tolerances of 25 millionths of an inch. Filters protect these components from abrasive foreign objects. The only moving parts are the low pressure gear type transfer pump, the cam actuated plunger in the injection pump, and the spring-loaded valve in the injector. Normal life of even the last two components is many thousands of hours.

When these components wear enough to adversely affect the operation of the diesel engine, they can be replaced economically enough to preclude rebuilding. The injector pump is held in place by four bolts. It can be installed properly by simply lining up a mark on the plunger rotating gear with a mark on the rack. High pressure tubing is attached to the top of the pump. The inlet port matches up with a supply line drilled in the pump housing.

The injector is screwed into the precombustion chamber, which in turn is screwed into the cylinder head. Both can be changed with a wrench as easily as a spark plug. No adjustments are necessary for installation or maintenance of these components of this fuel system.

Logistics will benefit from the use of diesel fuel. This fuel is less flammable than gasoline, eliminating much of the fire hazard. It is available locally in many areas in larger quantities and at a much lower cost than gasoline. And since diesel engine produces more horsepower per gallon of fuel burned, the volume needed will be reduced. Any fuel the enemy is using can be burned in these engines, enabling our forces to use captured fuels.

For these many reasons—reduced maintenance, greater safety, reduced logistical problems, more efficient operation, increased luggability, less smoke—Ordnance Tank-Automotive Command is developing and testing a complete line of diesel engines for its armored vehicles. The program has been underway for several years, and results indicate the changeover may be ready soon.

Achilles' Heel—

a Soldier's Eyes

By ROBERT W. FORSYTH and JOHN P. FORSYTH

IT is a recognized fact that in future wars, whether it be against the one major aggressive power in the world today or one of its satellite nations, United States ground forces will be greatly outnumbered!

American military leaders have long been aware of this situation and have planned and executed the development of our modern Army accordingly. To compensate for the numerical superiority of our potential enemies they have stressed, among other things, increased mobility and increased organic firepower for our ground forces, higher unit and individual training standards and increased protection from enemy fires for combat personnel to conserve manpower. This last factor, increased protection for combat personnel, has been growing in importance in our Army since World War II, and with the introduction of nuclear weapons to the battlefield it has become the object of intensive research and development.

Protection of combat personnel is, of course, separated into two distinct categories; active, the protection characterized by armored fighting vehicles, and passive, the protection characterized by gas masks, steel helmets and body armor. Active protection is a relatively new military concept, the first equipment embodying it being the tanks of World War I. Passive protection, on the other hand, is nearly as old as the history of warfare—it dates back to the use of the first crude shield by one of our bellicose ancestors. This article deals with the latter subject, passive protection, and more specifically with an area that has been neglected far too long by a nation that prides itself on its high regard for its human resources.

Personal passive protection equipment. The eye shield and the armored vest. The gas mask can be added if required.

A cursory review of our Army's current stock of passive protection equipment will reveal the availability of a satisfactory steel helmet, battle-tested, lightweight body armor and a modern gas mask. The first two items afford combat personnel adequate protection from shell, mine and grenade fragments traveling at ballistic velocities and some measure of protection from small arms fire. Constant use of the equipment in combat areas significantly reduces the incidence of cranial and trunk wounds and often means the difference between a fatal and a nonfatal wound to the soldier. The gas mask, although not required in recent conflicts, has been constantly modernized by the Chemical Corps and the latest model, the E13, a revolutionary type that does not employ the conventional bulky filtering cannister, will provide troops with a high degree of protection from chemical, biological and radiological agents.

But what equipment is available to afford combat personnel protection from possibly the most tragic of all battle incurred wounds—nonfatal eye wounds, that result in partial or total blindness? The answer, shocking in this day of advanced technology, is none!

Since every large industrial organization in the United States provides those employees requiring it with some form of eye protection, the logical question to pose at this point is why doesn't the Army do the same for its combat personnel? The answers that can, and probably will be offered for this question would undoubtedly take more space to record than is available in this article, but let us examine two possible answers that on the surface, at least, appear most valid.

First, most will claim that the total number of battle casualties suffering blindness caused by nonfatal eye wounds has been so low that the expense of developing eye protection equipment, the expense of procuring

ROBERT W. and JOHN P. FORSYTH, business associates in independent research on combat vehicles and weapons, are located in Burbank, California. They wish to express their sincere appreciation to the following people whose assistance made the preparation of this article possible: Major General H. N. Toftoy, CG, Aberdeen Proving Ground, Md.; Colonel L. A. Codd, Executive Director, American Ordnance Association, Washington, D. C.; Lt. Col. H. E. Whitmore, Assistant to the Director, U. S. Army Ordnance Research Laboratories, Aberdeen; E. L. Martin, Chief, Medical Statistics Division, Office of the Surgeon General, Department of the Army; and The American Optical Company, Buffalo, N. Y.

NONFATAL BATTLE CASES WHICH RESULTED IN BLINDNESS: BY SELECTED CAUSATIVE AGENT GROUPING, U. S. ARMY, KOREAN WAR

Preliminary, based on tabulations of individual medical records

Type of residual disability	All Agents	Explosive projectiles	Grenades, land mines, etc.	Small arms	Other & unspecified agents
Blindness, partial or total	1,400	720	375	172	133
Absence of eye, acquired, bilateral	10	7	2	1	—
Other blindness, partial or total, bilateral	120	59	30	19	12
Absence of eye, acquired, unilateral	739	382	192	100	65
Other blindness, partial or total, unilateral	531	272	151	52	56

and issuing it, and the added weight imposed on the soldier required to use it, can hardly be justified. A glance at the table, on this page, which lists battle casualties of the Korean War who suffered partial or total blindness as a result of eye wounds, will reveal that the number of cases was not so low. As a matter of fact when we consider the rear area medical effort required to care for such casualties, the expensive and protracted rehabilitation period, the continuing cost to the Army and the nation of disability pensions, and most important the great personal tragedy loss of sight represents to the individual, we realize that the number of cases was high indeed. In view of this then, can we really begrudge the relatively small sum of money that would be required to develop eye protection equipment and to procure and issue it, or the time required to convince troops of the value of carrying and using it?

Second, some, of course, will state that the Army doesn't provide eye protection equipment to combat personnel because it is not available and it's impossible to develop. Well we will agree that military type eye protection equipment is not available, but the airplane and the tank were not available at the beginning of this century either! As to the flat statement that it is impossible to develop such equipment, we can only relate that one of the largest safety equipment firms in the United States, which specializes in the development and manufacture of eye protection equipment, has stated that a clear, laminated plastic material, capable of withstanding the impact of shell, mine and grenade fragments traveling at ballistic velocities, could be developed and produced as a lens for goggles or as a complete face shield. The illustrations show what eye protection equipment utilizing such plastic material might look like.

If we continued to examine answers as to why the Army does not have eye protection equipment for combat personnel we would find, just as we have in examining the foregoing ones, that they lack foundation in fact—that there is no reason why the Army should not provide combat personnel with eye protection equipment. Furthermore, it is obvious that if we wish to reduce battle casualties, increase and maintain the combat efficiency of our ground forces in the face of enemy fire and conserve our military manpower, and thereby take the edge off the sword representing the numerical superiority of our potential enemies, we had better develop such equipment immediately. Naturally eye protection equipment will not eliminate wounds causing blindness, but it will certainly make the frequency with which they occur tolerable, and it will close the one gap in the passive protection equipment the Army now issues to combat personnel.

Flexible eye shield mounted on a modified helmet.

Semi-fixed eye shield mounted on the presently issued helmet.

"WHY NOT DIVARMOR?"

By LIEUTENANT COLONEL FRANCIS J. KELLY

ON 28 January 1959 changes in the organization of the infantry division were ordered by the Department of the Army and United States Continental Army Command. Without going into a detailed investigation of the specific changes, it is readily apparent that the revisions were in keeping with the axiom that "we progress or regress—who stands still, stagnates."

Obviously, the basis for these amendments was the desire to improve the personnel-firepower ratio, with the objective of achieving more effective destruction without additional personnel commitments. The changes, resulting in the concentration of additional firepower, did increase the kill ratio.

There is an additional area, however, which has not been thoroughly investigated and that is the massing of tank fires currently available within the infantry division.

Opinions vary as to the efficacy of the tank in the fire role it should play in combat operations. Some hold that the tank is primarily and singularly a direct-fire weapon. Other factions would play up its indirect fire capability as the primary role. What is often overlooked is the simple fact that the tank has both capabilities and can combine fire *and* maneuver.

Mobile, combined-arms warfare techniques will be the common denominator on future battlefields, nuclear or non-nuclear. It is not sufficient to install reactionary changes in either force structure or statistical evaluation. (Reactionary is intended in its generic sense—changes resulting from conditions that present a problem, and a solution is reached as a result of the posing of the problem.) Changes in nomenclature or even in force structure are not sufficient, if such changes merely revise old terminology or regroup existent ideas. How much difference in employment really exists between two (regiments) up and one in reserve, or three (battle groups) up and two in reserve? New concepts are needed, or surely the old ones will not survive a radically different environment of war.

Use All the Firepower

The firepower of the infantry division tanks is not being wasted, nor should such inference be drawn. Yet it is questionable if total capability is being used to its maximum. For example, the following tank and antitank fires are organic to the infantry division.

Tank, 90mm gun	92
Tank, 76mm gun	33
Gun, 90mm, self-propelled, *M56*	20
	145

This sum of weapons is more than twice the number of artillery howitzers and launchers currently available within the infantry division as indicated in *Table 1.*

What method can be employed to take maximum advantage of the tank and antitank capabilities of the division? A proposed solution is to establish within the division an organization analogous to that of division artillery.

The major subordinate elements of the infantry division as currently constituted are indicated in *Figure 1.*

It is proposed to adjust this organization by establishing an armor organization as shown in *Figure 2.*

Lest it be assumed that this is a nomenclature reform along the lines previously discussed, examine the DIVARMOR organization, as shown in *Figure* 3 (Division Organization),

3 battle group support battalions, towed	
105-mm howitzer, towed (each battalion—6)	**18**
155-mm howitzer, towed (each battalion—6)	**18**
2 battle group support battalions, self-propelled	
105-mm howitzer, self-propelled (each battalion—6)	**12**
155-mm howitzer, self-propelled (each battalion—6)	**12**
1 division support battalion	
8-inch howitzer, towed	**4**
***Honest John*, self-propelled**	**2**
Total	**66**

Table 1.

LIEUTENANT COLONEL FRANCIS J. KELLY, Armor, a University of Maryland graduate, received his MS degree from Georgetown University. During World War II he served in Europe with FIRST ARMY. Subsequent assignments included the General Staff, D/A and SEVENTH ARMY. During a tour in Korea he commanded a tank battalion and was Chief of the Special Weapons Instruction Team, EIGHTH ARMY. After attending C&GSC he was assigned to his present position on the staff and faculty at Fort Leavenworth. This thought provoking article appeared in the August issue of *The Military Review* and is reprinted here with permission of the editor.

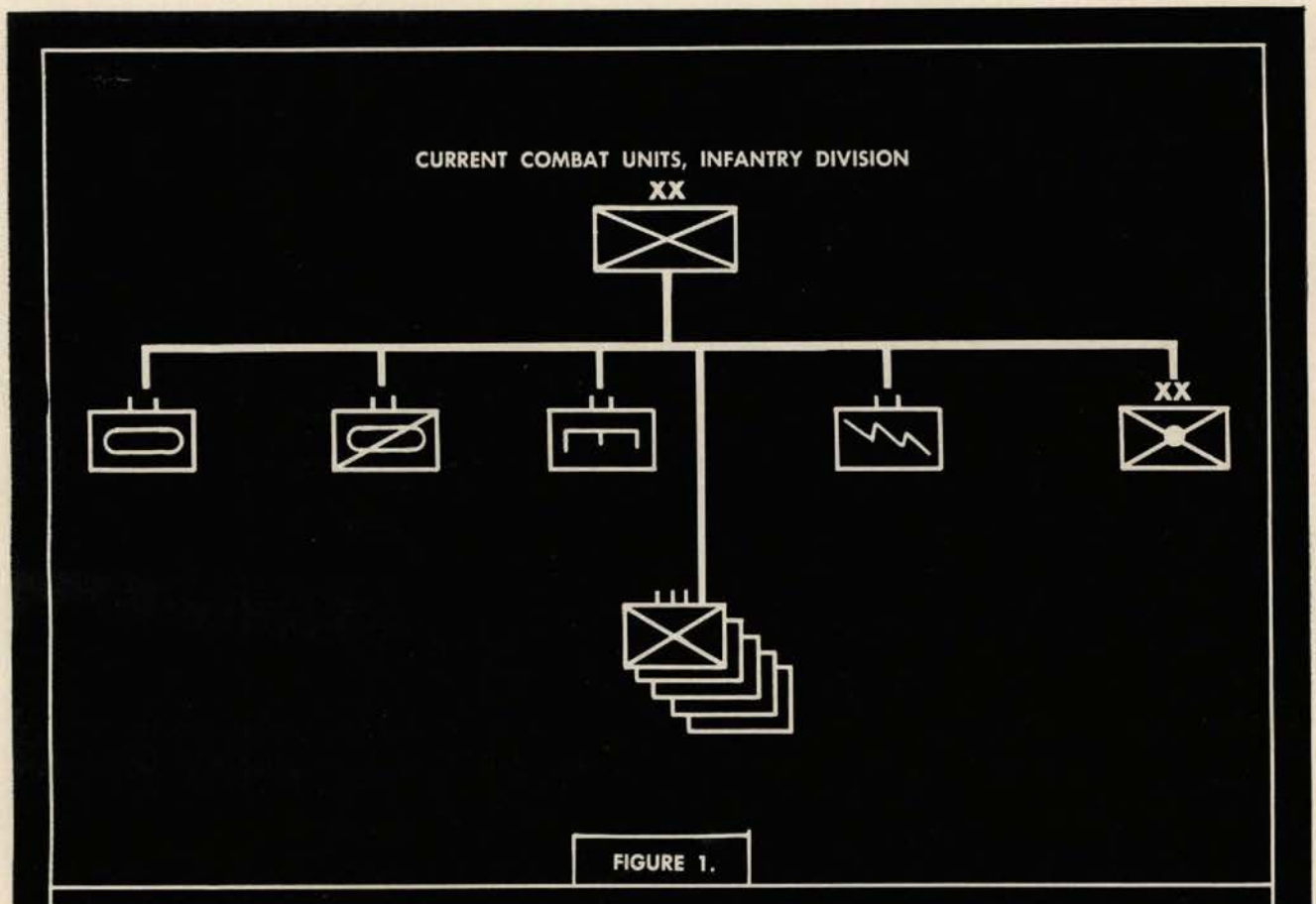


FIGURE 1.

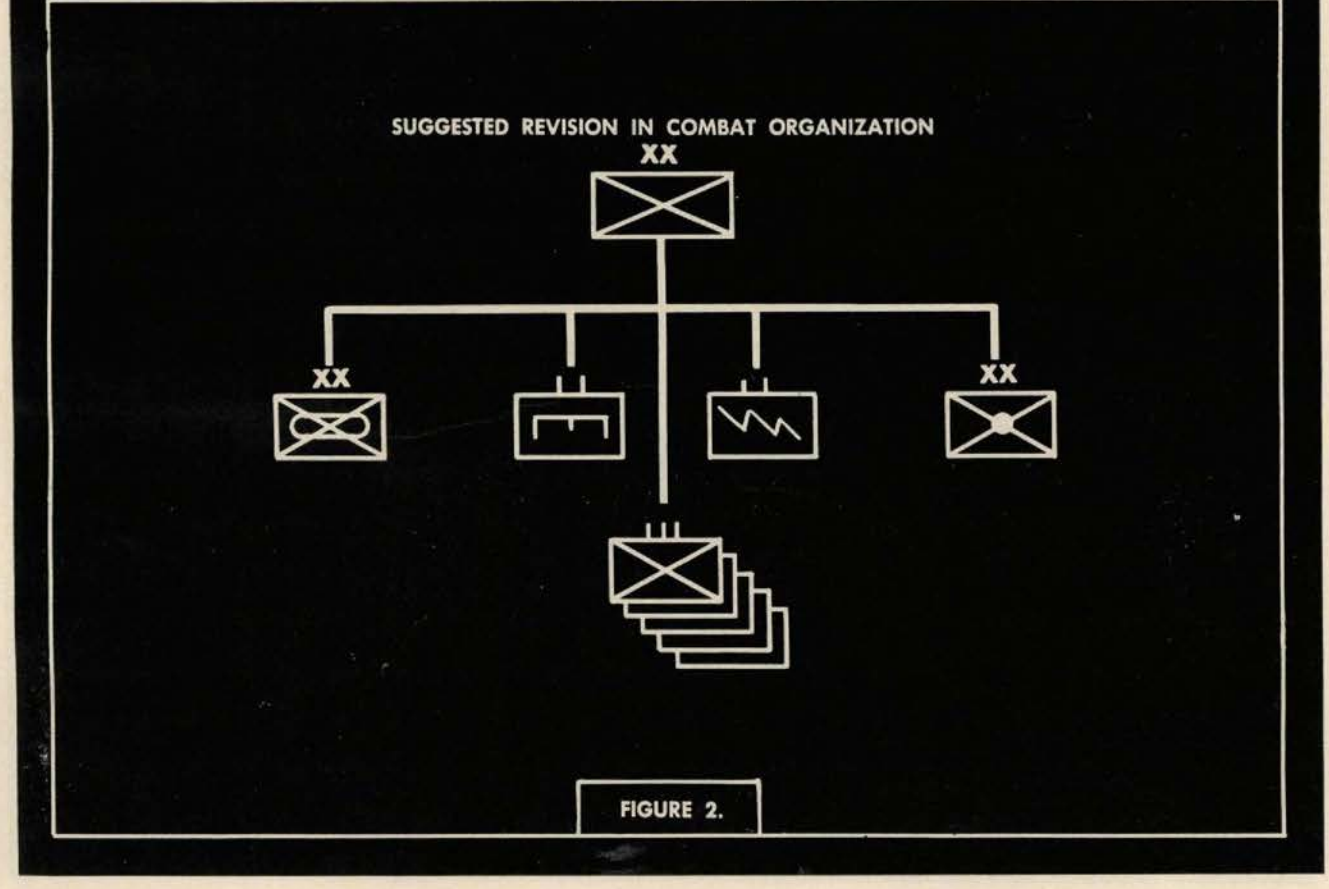


FIGURE 2.

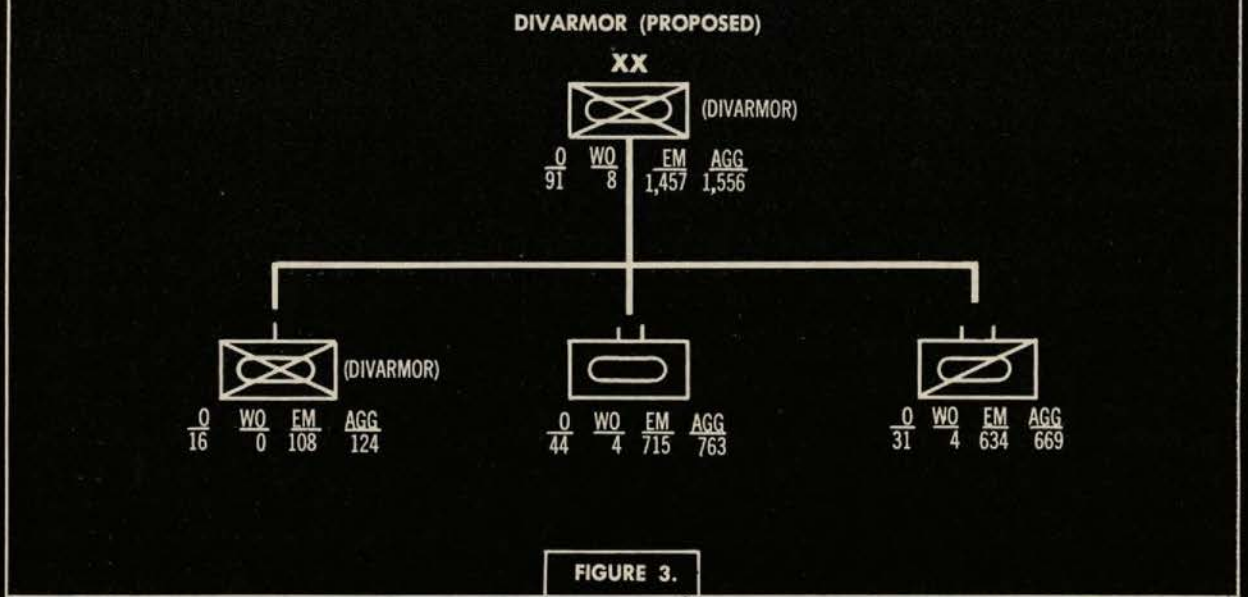


FIGURE 3.

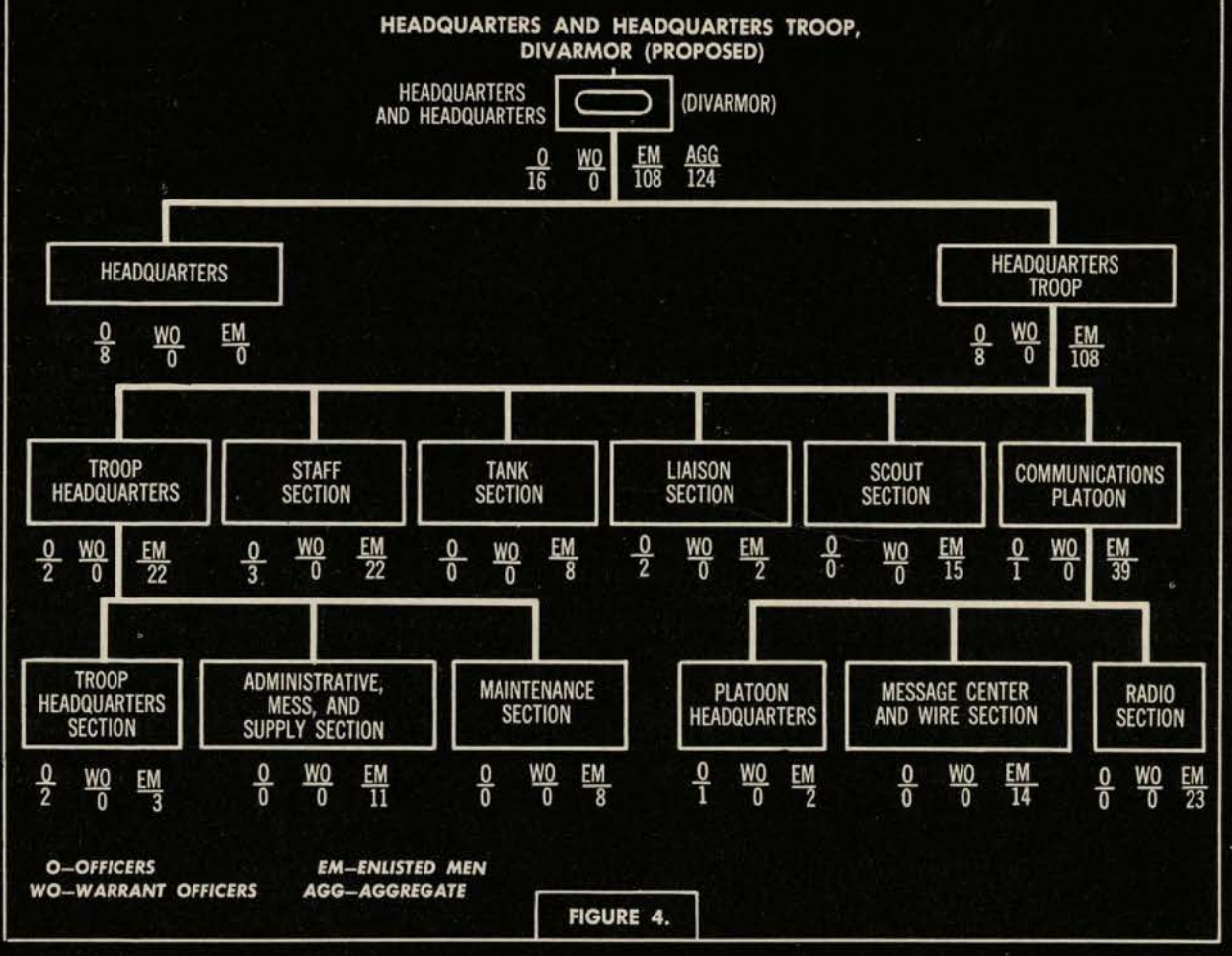


FIGURE 4.

and *Figure 4*, Headquarters and Headquarters Troop, DIVARMOR.

The headquarters and headquarters troop depicted in *Figure 4* is essentially the same control organization as found in the combat command of the armored division.

Specific Proposals

The specific recommendations proposed here are as follows:

1. Install the DIVARMOR organization as indicated.
2. Eliminate the position of assistant division commander.
3. Transfer the present duties and responsibilities of the assistant division commander to DIVARMOR.
4. Eliminate the brigade concept and personnel requirement.
5. Expand the division tactical operations center by inclusion of an armor fire coordination section (AFCS).

One of the primary considerations in nuclear warfare is the provision for an alternate command post (CP). It is presumed that this requirement, along with that of a readily available headquarters for special task forces, prompted the establishment of the "brigade headquarters." If an alternate CP requirement ever materializes, obviously the brigade headquarters, withdrawn from the division staff, is likely to prove ineffective. The positions and personnel of the brigade staff are provided by tables of organization and equipment, but are mingled within the staff sections of the division headquarters. If the division headquarters were rendered ineffective, it is a little shortsighted to expect the brigade designees to be spared.

Nonetheless, the major requirement for a readily available headquarters for special missions or task forces as needed is still present. The establishment of DIVARMOR more than adequately meets the needs of both an alternate CP, capable of immediate operation, as well as an effective, trained nucleus for the conduct of mobile combat operations of a combined nature on a nuclear battlefield. This arrangement would increase the flexibility of the alternate CP assignments, thereby adding insurance to any plan for continuity of command.

The position of assistant division commander (ADC) currently fluctuates in responsibility in direct proportion to the personalities involved. It is somewhat of a misnomer in any event, for if the commanding general is not present, the next senior general officer becomes commander, and very often it is the division artillery officer rather than the ADC who assumes command. It is believed the functions of the ADC could be carried out effectively by division armor.

Certainly, in the fields of communications, supply and maintenance—as well as the coordination of support for all track vehicles within the division—the multiple combinations of applied support facilities over greatly extended distances cannot be overlooked. Yet such communications and logistic procedures do not just happen, they must be carefully planned and controlled or support will be lacking.

DIVARMOR as conceived here could be charged with the responsibility for planning and discharging counterattack plans, division antitank planning, technical advice on, or operational responsibility for, rear area security and rear area damage control, as well as the supervision of division training in noncombat conditions. Much as the division artillery officer is charged with marshaling comparatively static artillery fire, the division armor officer could just as easily be charged with marshaling the division's maneuvering firepower. This would, of course, demand great coordination of fire support within the division area.

Fire Support Centers

In fire support coordination centers (FSCC) the techniques now in use are fairly stylized and have been refined over the years, rather than revolutionized. Thus it is a point of conjecture as to whether the current technique of an FSCC is suitable for nuclear warfare. Certainly, it is reasonable to examine its modernity in view of the tactics which will be required for nuclear existence. The need for cohesive planning, particularly in a nuclear situation, is overly obvious.

With this in mind it appears that the concept of a division tactical operations center (DTOC) is a more satisfactory solution to the complicated interplay of all manner and means of tactical support. In this concept, DTOC would function under the staff supervision of the G3 and would control and integrate current tactical operations with organic and non-organic tactical support, among other functions. The TOC is organized on the basis of eight principal duty sections. These are: G2-G3 operations; air defense section; fire support coordination section; tactical air support section; electronic warfare section; chemical, biological, and radiological section; engineer section; and Army aviation section.

Note that the extensive armor firepower is not included or considered. It is proposed that an additional principal duty section, the armor fire control section (AFCS), be added.

The armor fire control section (AFCS) would be that portion of the armor staff which operates in the TOC and which coordinates and integrates armor support with current tactical operations. This section would provide centralized review of armor requirements, support, capabilities and limitations. Within this section, advice on the employment of Armor could be obtained and the judicious use of armor communications and support facilities could be integrated into current tactical operations for the most efficient and economical use of all armor or armor type vehicles within the division, exclusive of artillery and engineer carriages or prime movers.

Adoption of the DIVARMOR organization would result in a minimal increase in personnel. The proposed organization *(Figure 4)* shows 16 officers and 108 enlisted men as the complement of headquarters and headquarters troop, DIVARMOR. A reduction by at least a factor of 0.4 is considered quite practical, since the functions of supply, maintenance and other forms of administrative support can be satellited upon existing divisional units. The main point is that with a very minor increase in personnel, the resultant improvement in delivered firepower is a highly profitable arrangement.

Clearly, we need every weapon firing at maximum effectiveness, if any imbalance in strength of forces is to be overcome. Some solution to intensifying the kill capabilities of the infantry division weapons must be found. Why not DIVARMOR?

By JAC WELLER

A Study of the Leadership of General Francis Marion

INDEPENDENT COMMAND

MARION received the name Swamp Fox from his enemies. He would suddenly materialize from the Low Country wilderness, strike a blow and disappear into the Carolina swamps. British Colonels Tarleton, Watson and Wemyss each in turn pursued him with superior numbers of British regulars and Tory auxiliary all to no purpose. Marion surprised his foes dozens of times, but was never surprised himself.

Marion's skill as a partisan sometimes obscures, however, his far more important military virtues. He did more than strike and disappear. He could even fight efficiently, if required to do so, in formal actions against disciplined infantry and cavalry. More important, he held territory for the Patriots in a manner not unlike that which may be employed by some future independent commanders in atomic war. There were few static "lines" in the Southern Revolution. Marion had no permanent base for most of the war. The large area which he controlled could be penetrated by an enemy column, but not conquered, nor permanently held. Marion had a flare for leadership, not only with his soldiers, but also his civilian countrymen. The basis of his strength was mobility and dispersion.

MR. JAC WELLER, a frequent contributor to ARMOR, is a graduate of Princeton. A firearms consultant and engineer, he has written extensively on weapons, history and tactics, concentrating on the Civil War and American Revolution. He is an honorary curator of the museum at the United States Military Academy and advisor on old weapons to the DOD.

Marion Personally

In order to understand the general, it's necessary to know something of the man. Let's look briefly at Marion's background. His four grandparents were French protestants who came to South Carolina around 1685. They were hard working and industrious with few social or economic distinctions. Young Francis appears to have had a minimum of education and to have preferred hunting and fishing to financial or agricultural success.

Although possessed of both stamina and ability to withstand privation, he was neither large nor powerful of frame. He had been, however, a brave and able soldier in some Indian campaigns and was elected a captain in the South Carolina Army raised in 1775. He soldiered well and rose in rank, even though he was 43 in 1775.

Major Marion was second in command to Colonel Moultrie of the Palmetto fort on Sullivan's Island which defeated the British naval and amphibious attack on 28 June 1776. Colonel Marion commanded the Second South Carolina Continental Infantry against Savannah in October 1779 in collaboration with the French under D'Estaing. Marion's period of independent command did not begin, however, until after the fall of Charleston and most of the rest of Georgia and South Carolina to the British in May 1780. This was a time of great discouragement in the South. Marion went into the Low Country he knew so well and raised irregular bands. Even when the American Continental forces were driven from North Carolina, Marion still held the most of the Low Country of both Carolinas for the Patriots and made progress, not only militarily but politically, against the British and Tories.

Marion's leadership was based more on material factors such as common sense, honesty, integrity and efficiency than on personal magnetism and advertising. He was practical rather than theoretical. Above all, Marion was successful; this is of such great importance in war, particularly bitter, tragic civil war such as was waged in the South. Marion was victorious in dozens of skirmishes and in a few small battles.

The reasons for his victories are not hard to find. He was essentially a simple man, yet he grasped intuitively what we now consider to be military science. He organized and taught; he was eternally vigilant. Few

independent commanders have ever done so well with their military intelligence. Marion's political strategy in holding friends and intimidating foes was truly remarkable. His ability to get the best from his less than perfect troops, both tactically and strategically, is worthy of careful study. He wore down superior forces and contributed mightily in the final Southern victory in the Revolution. We will discuss certain phases of Marion's abilities which contributed to his success and produced his type of leadership.

Topography

Throughout military history a knowledge of topography and the mastering of details of it for military purposes have been the hallmarks of great captains. Tidewater South Carolina presents extreme problems. The country even today is obscure; ground observation is limited by its flatness and predominant wooded condition. At the time of the Revolution, there weren't even any roads worthy of the name. Maps were defective. Small cultivated clearings were lost in pine, cypress and oak forests, save for a few large plantations. There were sluggish streams and the typical Low Country swamps. These last were generally not morasses, but stretches of shallow water out of which cypress and a few other trees grew in profusion, sometimes to a height of more than 100 feet. The whole country was blind; reconnaissance depended upon the horse and a near perfect knowledge of the local trails. A few active men, not afraid of water moccasins and an occasional alligator, can go almost anywhere. Even a small column of soldiers, however, required competent direction and leadership. Marion excelled in these; his strategic plans were based on mobility and speed. Marion once moved more than 100 miles in 60 hours along trails unknown to his enemies to win a small battle at Parker's Ferry well southeast of Charleston. British thought him near Georgetown, 100 miles to the northwest.

Marion was born and reared in the country he later fought in; he had hunted and fished almost throughout his theater of operations. But so had many of his Tory opponents and almost all his own troops. Marion only had a memory for topographical detail and a sense of direction which appears never to have failed him. Local guides are useful on occasion, but have been unreliable in a crisis throughout military history. The commander is fortunate indeed who knows his theater well personally. Marion appears to have been able to follow even at night almost any trail that he had ever gone over even once before in his life. He employed these abilities often to arrive after marches of 50 miles, or even more, exactly where he wanted to be and at exactly the right time for a surprise attack. His retreats were equally well handled. Even today, with all our remarkable maps, compasses, bearings and the like, columns go astray in far less difficult country.

Knowledge of People and Economy

Marion at the time of his greatest usefulness had lived almost half a century in Tidewater South Carolina. His mind was uncluttered with a great mass of miscellaneous academic facts. He had instead a phenomenal memory for names, faces and details. He knew not only the vast majority of people in his theater, but also what they did for a living and how well they did it. He had accurate knowledge of a variety of different matters. He knew, for instance, where to get the mill saws common at that period and where to take them to have local blacksmiths fashion them into cavalry sabers. He knew where to get bushels of salt, a priceless commodity for both soldiers and civilians. He knew the probable ability of almost all militia officers, both Whig and Tory. He knew how to appeal to people as individuals for best results. He used this personal knowledge along with common sense in his remarkably efficient gathering of information.

Care of His Command

Marion, like many other able military commanders, had no outstanding ability to fraternize with his men. He wisely kept at a distance from them. However, his entire command was handled as if it had been a clan, or even just a large family, with Marion at its head. He had a paternal attitude towards his men; he realized their problems. He was sorely tried with their comings and goings, yet he knew their situations at home. Most of his command served without pay and without security for themselves or their families should they be killed, or wounded and disabled for life. There were no family allotments; Marion's men still had to feed their wives and children. Planting and harvesting times were bad for active operations. There were little problems which needed an understanding of the individual. A horse was practically a necessity of life. A man who lost his horse had to have a replacement for both military and civilian life. Men would not serve without a horse. Marion provided remounts somehow.

Marion's care of his men in camp and on the march was secondary to his desire to protect them in action. His first objective was always to save the lives of his own men. He made plans in such a way that his victories cost a minimum. Marion's men were volunteers who would not serve under a commander who bought victories with the blood of his men. He never had enough of them. His inventive mind adopted strategy and tactics by which large losses could be avoided, even among the opposition. Marion sometimes surprised and utterly defeated Tory commands with almost no one hurt on his side, and with a minimum of enemy casualties. His small victories usually produced at least a few recruits from the opposition.

Marion's Discipline

Marion realized from his early contact with British regulars the military advantages of strict discipline obtained by severe physical punishments. Even in the American Continental forces, however, the British type of group unity and cohesion in regiments were probably unattainable. In later volunteer organizations, strict discipline was a relative term only. Marion was able to impose better order and appearance than in some commands by the force of his own character based on sincerity and fairness, as well as tact and common sense. He could appeal when an appeal was necessary; he commanded when he knew he would be obeyed. Finally, he knew when to be lenient; often, no other course was really practical. His troops were less cruel, and did less robbing than any of their contemporaries, but would hardly seem praiseworthy in these respects, for instance, in our Civil War.

Logistics

Independent commands throughout history have been no more effective than their supplies of food, clothing, weapons and transportation. These matters were of very first importance during the Revolution because of extreme material scarcities. The ammunition problem was particularly trying; the American forces in the Southern Theater sometimes had almost no powder for weeks at a time. Marion obtained the small quantities he had to have only after considerable trouble involving thought, personal knowledge and common sense.

Marion's volunteer soldiers commonly brought with them both a horse and a weapon of some kind. The horse had to be fed along with the man; the replacement of the animal has already been discussed. Firearms presented peculiar problems in the South. Few of those in the hands of Patriot irregulars were ideal for military purposes and had to be replaced where possible. Even more important, all arms had to be kept in repair in an area almost destitute of gunsmiths.

So many other things were necessary. The Continental forces had a primitive system of Commissary and Quartermaster supply. The commanders of State troops usually had to provide almost everything for themselves. The success of an independent command in the Revolution sometimes depended more on the ability of its CO to solve problems of supply than his capacity for battle. Marion not only was able to do this, but greatly increased his personal prestige by doing it comparatively very well indeed.

Personal Bravery

Officers deficient in personal courage seldom accomplish much on active duty with relatively small commands. In Marion's day, an officer would have to be within a few yards of hand to hand combat, even if he did not engage in it himself, in order to exercise command. In his early life, Marion led what was then called a "forlorn hope," a small force which spearheaded an attack on a fortified position. He was never foolhardy; he realized his limited ability with personal weapons. However, Marion was one of the few men to gain the parapet of the British earthworks outside Savannah. He was cool under fire; even more noteworthy, he would lead his command over broad streams at dead of night, although he could not swim. He trusted to his horse to do the swimming for both of them.

Breadth of Vision

In spite of his lack of formal education, Marion showed almost alone among the Southern independent commanders a grasp of the whole picture of the war in the South. He more than anyone else was willing to cooperate with Nathanael Greene, Harry Lee and other Continental officers for the common good. He was fair and merciful not only because of his personal feeling in that direction, but also because of the importance of these qualities in ultimately winning the political war in the minds of the Southern people, only a relatively small portion of whom had been Patriots at the beginning of the war.

Strategic Concepts

Marion certainly never wrote down any rules for war. However, a study of his operations yields a fairly definite list of precepts. Nothing appears to have been so important to Marion as simplicity. He realized the limitations of his own command; his staff was rudimentary. If things were to go well, they had to be simple. Simplicity will always be a great military virtue.

Second, Marion was cautious and vigilant. He was able to surprise his foes; he spent much of his time and energy guarding against surprise by the enemy. His intelligence system served him well here, especially when supported by his semi-organized civilian auxiliaries. He moved his camp so often that even dispatches from other American commanders had trouble catching up with him.

Third, Marion, like all natural soldiers, had an intuitive grasp of certain basic principles of economy of force in warfare. Perhaps the most important of these was surprise. He attacked his opponents many times when they were encamped. He was a master also of imposing on his enemies in many ways. He was particularly fond of feigning a retreat with a small force in order to draw the enemy into an ambush, as at Blue Savannah. He used the advantages of attacking from the flank or rear.

Fourth, Marion kept his own counsel in regard to his plans and aims. His efforts at gaining intelligence from all possible sources were never ending, but he kept the information to himself, save, of course, for passing some of it along to his superiors. His men did not realize that an offensive move was contemplated until it had started. Such arrangements were particularly important in the Revolution when desertions were fairly frequent; interrogation of prisoners and deserters by the enemy was almost universally successful. Spies were common, often serving both sides.

Fifth, Marion was a master of using mounted infantry. He moved his men all mounted swiftly and silently. Once ready for action, he would dismount most of them in order to use their weapons more efficiently. He realized the value of shock tactics also; at Black Mingo and elsewhere, he used some men mounted with sabers to break enemy formations. A commander of modern mechanized infantry will do well if he can adapt his force to local conditions and terrain as well as Marion did his so long ago. Although Marion could fight his command as infantry of the European type, as he did at Eutaw Springs with considerable ability, the real value of his brigade lay in its strategic mobility and tactical versatility. His countrymen could build a tower of pine logs to take an enemy fortress in a few hours of darkness.

Conclusions

Leadership is probably at least 90 percent the result of military ability and success in the field. Marion achieved both these because he knew his theater, his soldiers, his enemies and the basic arts of command. He won victories cheaply; he could preserve his forces and his territory against superior odds. He was able to confound his enemies, both military and civilian; he finally won many of them over to his side. In doing these things, he came to inspire his troops, the pinnacle of command ability. The little South Carolinian was a great leader at a critical time and in a critical area. He did much for his country.

THE PAPER TIGER

or

INTEGRATED DETERRENCE?

By SECOND LIEUTENANT THOMAS E. CARPENTER, III

THE past decade has witnessed the birth and rapid growth of a strategy founded on the premise that the threat of nuclear bombardment will thwart the aggressive designs of World Communism. The asymptotic growth of this concept and the striking force to implement it has taken place when economic policy demanded that a fixed fiscal ceiling be placed on defense expenditures. For this reason, the past decade has also witnessed a steady decline in our ability to wage a non-atomic limited war.

The dramatic launching of Sputnik, the surfacing of Russian aims in the sea of Middle Eastern strifes, and the current Berlin crisis have touched off much soul searching in the area of national security. Many thinking men who have one eye on the record to date and the other on what lies ahead have voiced doubts concerning the past success of *massive retaliation* and more important its ability to cope with the Communist challenges of today and tomorrow. It is the purpose of this paper to bring into focus a few of these doubts.

No one this side of sanity will deny the need for a strategic deterrent force. Few men will take issue with Winston Churchill when he says that the mere presence of America's Strategic Air Command has kept the free world from the holocaust of World War III. It is not the presence of a strategic nuclear deterrent, but rather what appears to be the absence of an adequate limited war capability that is the basis for most of the doubts that we propose to bring into focus. In other words, there is a feeling that *massive retaliation* can only meet the Communist challenges on one level and hence we must search for other means to counter limited thrusts. Having glanced at the main source of concern let us examine the policy in question to see why in my opinion it cannot successfully meet the challenge of limited war.

As I mentioned earlier, massive retaliation depends on the threat of atomic war to deter aggression. For any threat to be effective, four factors are essential!

1. The threatening party must have the means to fulfill the threat.
2. The threatening party must have the will to employ these means.
3. The threatened party must see clearly the presence of the means and the will to employ them.
4. The fulfillment of the threat must be more damaging to the threatened party than abandonment of the issue at stake.

Should any one of these factors be missing, a threat becomes an empty bluff that weakens the position of the threatening party. Every unfulfilled

SECOND LIEUTENANT THOMAS E. CARPENTER, III, Armor, graduated from USMA in 1958. He attended the Armor Officers' Basic Course at Knox and the Airborne and Ranger Courses. He is presently assigned to Headquarters and Headquarters Company, 3d Armored Cavalry Regiment, stationed at Fort Meade, Maryland.

threat makes the next one less plausible until at last one becomes a *paper tiger*. When one leg is missing and the bluff is called, the table falls.

Now we must ask ourselves a vital question. Does the threat of nuclear devastation, which is the heart and soul of the doctrine of massive retaliation, contain the four essential elements that give meaning to any threat?

We need not belabor the first factor. The United States today has the in-being capacity to devastate the Soviet Union or any other would-be aggressor.

We will come back to the second factor.

Concerning the third factor, the Soviets by their bitter denunciation of *capitalist encirclement* have made it known that they can clearly see the means. Our world wide deployment of the Strategic Air Command leaves no doubt in anyone's mind about factor number three.

Pictures of a Pacific atoll simply vanishing into the ocean will convince any skeptic that factor four is present. It should be obvious that the realization of a nuclear threat would be more damaging to any society than the abandonment of some goal. No issue is more important to a nation than its survival.

Let us address ourselves to the remaining factor. Remember that in its absence all our threats are "full of sound and fury, signifying nothing." Do we have the will to make good on a thermonuclear threat? The record shows we do not.

From 1945 to 1949 the United States was the only nation that possessed a nuclear weapon and the means to deliver that weapon to any point on the earth's surface. We were clearly committed to the defense of freedom, having just fought a world war to match our words with deeds. Yet John Gunther in his book, *Inside Russia Today,* points out that the Communist cancer spread at the rate of more than 50 square miles per hour during this same period, 1945-1949. The challenge was there but the will to unleash the nuclear deterrent was not.

In Korea, Malaya, Vietnam, Hungary, Tibet and Iraq we have demonstrated beyond doubt that when the chips are down we will not play our ace-in-the-hole. Thus, we have said much and done nothing about the employment of nuclear weapons to deter aggression in the past. In short, the policy of *massive retaliation* has failed to meet what Kissinger calls in his book, *Nuclear Weapons and Foreign Policy,* the "ambiguous challenge." That is the challenge of crisis that falls short of all-out atomic war.

As weapons graduate from the kiloton stage to the multi-megaton stage and the day of nuclear plenty for all approaches, our willingness to employ these weapons will diminish. For now we must not only consider the moral stigma that accompanies the use of atomics to punish an aggressor, but we must also reckon with the unpleasant prospect of retaliation in kind. Hence, one is not likely to see a strengthening of American will to use nuclear weapons in the foreseeable future. If anything, one might expect a weakening of our will during conditions of relative nuclear parity.

It seems clear to me then that the strategy of *massive retaliation* has proven itself incapable of coming to grips with the problem of limited war. Moreover, it appears that this strategy will be even less effective in meeting the ambiguous challenges that lie ahead.

In the past, the military has often been rebuked for trying to win the next war with the weapons that won the last war. History has shown this course to be an extremely dangerous one. Today we could well adopt a modified parallel: It may be just as dangerous to discard conventional weapons of *evolutionary* design, if we are unwilling to use weapons of *revolutionary* design or if the conditions under which we would be willing to use the latter never arise. Perhaps we have become so wrapped up in the Buck Rogers era that some barbarian will sneak up behind us and beat us to death with a non-atomic subsonic club, before our wonder weapons can even get off the ground!

So far we have been concerned primarily with our military strategy of deterrence, but in reality we cannot discuss this subject meaningfully without probing our grand strategy of deterrence. The doubts that plague many of us concerning massive retaliation go beyond the military realm and touch on matters of national strategy. Therefore, the solution to the problems posed here must include a discussion of the Communist challenge in its broadest sense.

On 3 May 1959, the State Department of the United States published an analysis of the Communist challenge that made front page news in many papers across the land. The following quote from that report should serve as a good starting point for our discussion of the nature of the threat we face.

> The post-Stalin leaders apparently have a realistic appraisal of Western strength and consequences of war in the nuclear age which leads them to rule out general war as a deliberate instrument of policy. It is likely that for the foreseeable future the Soviet and Chinese Communists will rely for the most part on political, economic and psychological means to achieve their objectives and expand their influence in the non-communist world.

As this quote suggests, the Communists rarely present us with a pure military challenge or a pure economic challenge. The reader will be hard pressed to name a single challenge of the last decade that does not represent a mixture of military, economic, political and psychological factors. Therefore, our responses to these challenges cannot be purely military or purely economic. We must use varying proportions of each factor to build a composite response. The factors that are selected for the response need not be in the same proportion as those used by the Soviets to make

up their challenge. The only requirement is that our response succeed.

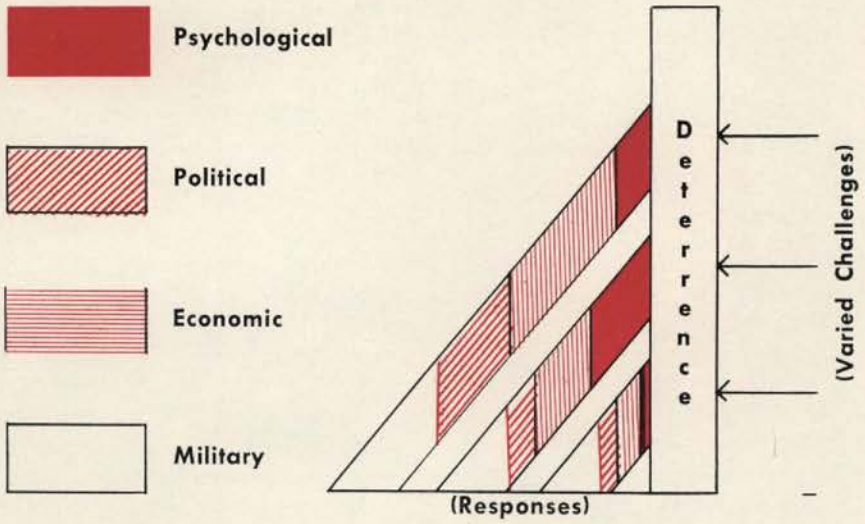
Within these several parts of each challenge there are also a variety of elements. For example, if the military factor is present it may take any one of a multitude of forms. It could be an all out atomic war, a limited war (as in Korea), or a guerrilla type war (as in Malaya), to name but a few.

To the Communist the struggle for world domination is a total one. He is prepared to attack us with a tremendous arsenal of military, economic, political and psychological weapons. There are an infinite number of factor combinations that can be used to mold each weapon. Dr. Stefan T. Possony in his book, *A Century of Conflict,* tells us that the cult of Communism envisions the use of an endless number of thrusts to destroy the free world.

There are some who say that it is impossible to counter every thrust made by the Soviets. I can think of no better expression of defeatism. This is like countering only a few moves made on the chess board. Is it not better to carry the fight to your opponent and seize the initiative from him by responding vigorously to his every move? It is the conviction of this author that we can and must meet world Communism on every level of challenge. This applies to each challenge regardless of the factor combination.

Preparedness must include an entire spectrum of possible responses. To succeed in meeting some challenges and to fail to meet others is to court disaster. We must have what might be called a strategy of *integrated deterrence* to counter Communist plans for world domination.

Perhaps the sketch will help to explain what is meant by the term integrated deterrence.



What steps must be taken to make this strategy a reality?

First, we must move quickly to build up our limited war capability. The examination of our massive retaliation policy at the outset of this paper has clearly shown the need for improvement in this area. A special committee of the United States Army Association, headed by General Matthew B. Ridgway, summed up this need on 2 May 1959, as follows:

> The present military posture of the United States is out of balance and incapable of exerting its full influence on war and cold war situations that lie on that broad spectrum between a 'simple showing of the flag' at one end and thermonuclear war at the other end.

Second, we must extend our programs for the training of foreign nationals in the techniques needed to counter Communist subversion, sabotage, and propaganda in their countries. There is absolutely no reason why we should abandon this field to the Communists.

Third, we must take measures to insure that American merchants, missionaries, and military personnel spend many years in the Afro-Asian bloc and Latin American countries. These men must keep their fingers on the pulse of the countries in which they are living. They must speak the language and understand the customs of these peoples, so as to bridge the gap between the so-called *uncommitted third,* who claim neutralism, and the United States. In a sense, they could act as liaison between the graduates of our schools of counter Communist subversion and our cold war decision making organ of government.

These in the very broadest of terms are the absolute essentials for a policy of *integrated deterrence.* This is no panacea for free world ills. I think it could be a step in the right direction. Of course, it is easier said than done, but it must be said before it can be done.

The American people do not like war. The American people must be shown that they are already at war and have been for some time. They must be made to understand the nature of this war and then act to win it. Some people say we cannot afford such a program. I say we can always afford it if we want to survive. The stakes are the highest in history and time is running out. A 2,000 year tradition of Roman law, Greek rationalism, French individualism, British civil rights and American equality hangs in the balance. Therefore, each one of us must spread the gospel of integrated deterrence to the American people. Free people can act only if they hear our case.

The Tank Gunnery Qualification Course

By CAPTAINS THOMAS G. FOSTER, III and JOHN M. PICKARTS

IN the near future, upon receipt of Change 3 to FM 17-29 and Change 2 to FM 17-80, all armor units will implement a new tank gunnery qualification course for annual qualification.

In developing this new tank gunnery training program it was accepted that the goal of tank gunnery training must be the effective employment of all tank-mounted weapons. As both the coaxial machine gun and main armament are crew served, the training objective must be a trained crew. It follows, therefore, that the effectiveness of a unit's firing capability can be evaluated only through crew testing. The current program trains, tests and classifies a tank crewman in only the position of gunner. This emphasis on the skills of only one member of the tank crew seriously detracts from the true goal of a trained crew. Therefore, in revision, the current tank gunnery qualification course has been changed to include a new course, which gains needed time and ammunition for the development of a new crew qualification course.

The course is divided into two phases, individual and crew. The first phase is the tank crewman's gunnery qualification course, followed by a second phase, the tank crew gunnery qualification course. The tank crew can now qualify for a badge. Another major change is the inclusion of a night firing exercise in the tank crew course.

Cross-training within the tank crew is still considered essential and the training of each crewman as a gunner will continue.

The tank gunnery qualification course will be conducted in two phases of the Army Training Program. The Tank Crewman's Gunnery Qualification Course is allotted 40 hours in the Advanced Individual Training Phase. The Tank Crew Gunnery Qualification Course will be fired in a period of 80 hours allotted in Crew and Selection Training of the Basic Unit Training Phase.

The new tank gunnery qualification course is designed primarily to provide the armor commander with a means of determining tank crew proficiency as well as gunner proficiency. The new courses are organized and conducted as shown in *Chart 1*. Classification of tank crewman will be based on the successful completion of the exercises conducted in the crewman's qualification. Crew-

CAPTAIN THOMAS G. FOSTER, III, Armor, a 1951 USMA graduate, served in Korea with the Tank Company, 5th RCT. Subsequent assignments took him to Panama where he served in various Reconnaissance units. Returning Stateside he was assigned to the 325th Tank Battalion, Camp Irwin, California. Attending the Advance Course he is now a weapons instructor at TUSAARMS.

CAPTAIN JOHN M. PICKARTS, Armor, served in the U. S. Marine Corps from 1942 to 1946. Graduating from University of California in 1950 he received his Regular Army commission. He served in Korea with the 2d Reconnaissance Company, 2d Infantry Division. Next he served in the 6th ACR. Attending the Advance Course he is now a weapons instructor at TUSAARMS.

Tank Crewman's Gunnery Qualification Course (Advance Individual Training Phase)

TITLE	EXERCISE	AMMUNITION REQUIREMENT PER INDIVIDUAL			RANGE REQUIREMENT	ATP HOURS
		Cal .30	90-mm	4.2 Mort		
Tank Crewman's Subcaliber Course	Preliminary Gunnery Examination					8
Table I	First-round hit	20 (ball)			200 feet	16
Table II	Primary and alternate method of adjustment	25 (ball)			200 feet	
Table III	Moving target	20 (tracer)			200 feet	
Service Course						
Table IV	Stationary targets		2 HE 8 AP		800-2,000 yards	8
Table V	Moving targets		10 AP		700-1,500 yards	8
	Total	65	20			40

Tank Crew Gunnery Qualification Course (Basic Unit Training Phase)

Table VI	Crew moving tank machine gun	600 Cal .30 200 Cal .50			Cross-country course	16
Table VIIA	Crew field firing (day)	200 Cal .30 200 Cal .50	8 HE 12 AP		Cross-country course	16
Table VIIB	Crew field firing (night)	200 Cal .30 200 Cal .50	8 HE 14 AP	6 illum	Cross-country course	24
Table VIIIA	Crew proficiency course (day)	400 Cal .30 100 Cal .50	4 HE 2 AP		Cross-country course	8
Table VIIIB	Crew proficiency course (night)	400 Cal .30 100 Cal .50	6 HE 2 AP	3 illum	Cross-country course	16
	Total	1,800 Cal .30 800 Cal .50	26 HE 30 AP	9 illum		80

Chart 1. Tank gunnery qualification course.

men successfully completing the subcaliber course will be classified as expert, sharpshooter or marksman subcaliber gunners. In addition, crewmen successfully completing the service course will be classified as expert, sharpshooter or marksman tank gunners. It is during this phase of gunnery training that the commander can observe and select the individuals with the best potential for additional training as gunners in the crew exercises.

Each tank crewman will be required to satisfactorily pass all tests of the tank crewman's preliminary gunnery examination before being allowed to fire the subcaliber tables. He must also pass the subcaliber course before firing the service tables for record. The crewman will fire the subcaliber tables twice, once for practice and once for record. The service tables, however, will be fired only for record.

Tank crews will be rated as expert, sharpshooter or marksman crews as a result of their participation in the crew qualification course. The gunners used during the crew exercises must have passed the crewman's preliminary examination.

Tank Crewman's Preliminary Gunnery Examination

The first requirement of this course is the tank crewman's preliminary gunnery examination, which is designed to assist the commander in determining whether his crewmen are proficient enough to commence firing the various exercises. The individual is required to demonstrate that he is proficient by physically performing all the mechanical operations necessary to maintain the equipment, prepare the tank for firing and follow proper conduct-of-fire procedures. In developing the new crewman's preliminary examination it was decided that more of the crewman's skills can and should be tested in this examination. Revisions of the present preliminary gunner's examination therefore include the expansion of several tests. These revisions will not require an addition of train-

ing time and can be conducted with basically the same equipment that is being used in the present examination. The complete crewman's examination covers the tests shown in *Figure 1*. Tests 1, 2, 3, 5, 9 and 10 are basically the same as those found in the present examination.

There is no longer a need for the present test 4, as the M1 gunner's quadrant will, in the near future, be deleted as an item of OVM. In place of the end-for-end test of the M1 gunner's quadrant is a test designed to determine the crewman's knowledge of standard tank ammunition. In this test, the individual is required to identify the round and state its primary tactical use and how it is announced in fire commands. To conduct this test, the unit needs only five types of tank ammunition and an individual to conduct the exercise. If the testing unit is unable to obtain the actual rounds, no serious training objectives will be lost if either pictures or drawings are substituted for the actual ammunition.

Test 6, zeroing the gunner's periscope, has been extensively expanded to include more of the crewman's skills necessary to accomplish an accurate boresight and to apply emergency and established zeros to the direct-fire sights. This test now requires the crewman to demonstrate administratively that he understands and is able to perform the steps necessary to boresight and zero the main gun.

In preparation for the test, a six by six panel with an eight-inch bull's-eye is set up at a range of 1,500 yards in front of the tank. A three-round shot group is marked on the target. To conduct the exercise the examiner places the computer and the elevation and deflection knobs on the M20 periscope and on the telescope out of adjustment. The examiner then designates the target and the crewman is required to boresight, apply emergency zero and zero the gun with the telescope and the periscope using the prescribed procedure. *See Figure 2.*

Test 7, initial lay and burst on target, has been amended to further test the crewman's ability to employ the primary and alternate methods of adjustment with both the periscope and telescope. In preparation for the

UNIT_____ NAME_____

DATE_____ GRADE_____ SN_____

TANK CREWMAN'S PRELIMINARY GUNNERY EXAMINATION RECORD

TEST NR	TITLE	SAT	UNSAT	REMARKS	EXAMINER'S INITIALS
1	Field disassembly and assembly of breech mechanism				
2	Putting turret in power operation				
3	Use of replenisher indicator tape.				
4	Identification and use of ammunition				
5	Checking and adjusting firing mechanisms				
6	Boresighting and zeroing primary and secondary direct-fire sights				
7	Laying primary and secondary sighting devices, and primary and alternate methods of adjustment				
8	Use of auxiliary fire control instruments in preparing and firing from a range card				
9	Adjusting headspace on caliber .30 machinegun				
10	Headspace and timing on caliber .50 machinegun				

LEGEND FOR REMARKS:
P–Procedure incorrect
T–Time limit exceeded
A–Accuracy not attained
X–Requires much more training

COMMENT: _____

	YES	NO
COMPLETELY QUALIFIED		

_____
Examining Officer's Signature

Figure 1. Tank crewman's preliminary gunnery examination record.

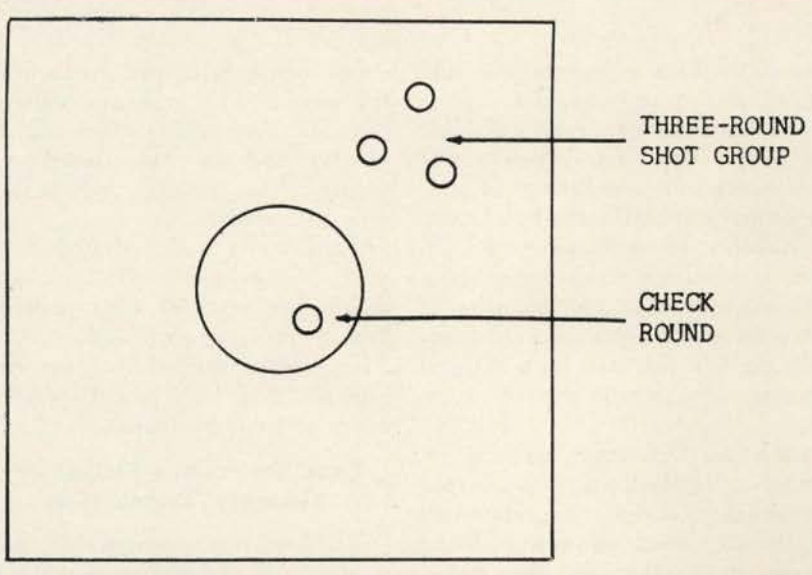


Figure 2. Target panel for boresighting and zeroing.

test, three six by six-foot panel targets, with tank silhouettes about four feet long and two feet high, are set up at a minimum distance of 300 yards in front of the tank. A shot that has missed the tank is represented on two of the targets by a red dot placed at random about one foot above the tank silhouette and near the left edge of one target and about one foot below the tank silhouette and near the right edge of the other target. *See Figure* 3.

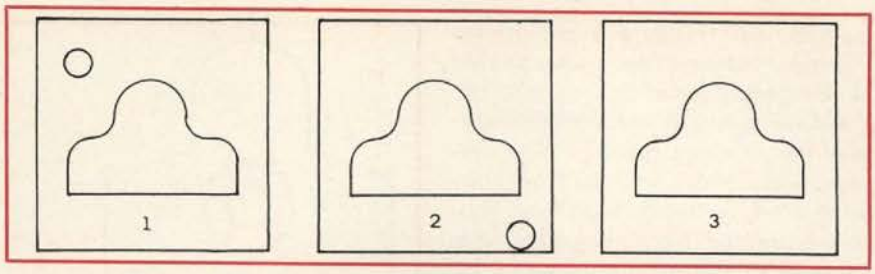


Figure 3. Target layout for initial laying and adjusting.

The crewman is required to engage three targets in response to initial fire commands issued by the examiner. The crewman first engages the three targets using the periscope, and then he engages the same targets with the telescope, employing both methods of adjustment.

The examiner will brief the crewman on the series of engagements and, when the crewman is ready, will lay the gun for direction, simulate ranging and issue a fire command. The crewman is required to turn on the gun switch, index the proper ammunition, announce ON THE WAY, simulate firing one round, apply burst-on-target (assuming that the red dot indicates a miss), announce ON THE WAY and simulate firing the second round. This sequence is repeated for the second target. The sequence for the engagement of the third target is identical; however, after firing the first round the crewman announces LOST and receives a subsequent fire command; he applies the correction, announces ON THE WAY and simulates firing a second round. The series of three engagements is repeated in the same manner with the telescope; however, the examiner must issue a five-element fire command. This tests the crewman very thoroughly on his knowledge of gunner duties in response to a fire command and on methods of adjustment.

Because of the equipment being employed, it is not necessary to actually fire a weapon to effectively train or test an individual on his ability to determine range card data and apply this data to the auxiliary fire control instruments. With this philosophy in mind the new tables have been composed to eliminate the present range card exercises as firing exercises. At the same time, however, it was realized that the scope in the present auxiliary fire control instrument test in the gunner's test was inadequate to cover the desired training areas. As a result, test 8 has been modified to completely examine the crewman on his ability to determine range card data, and once he has completed this phase, he is tested on his ability to properly apply data to the auxiliary fire control equipment. Again, as with the other tests, a simple target setup is designed. Five targets with one-inch bull's-eyes are set up on a vertical wall about 1,000 inches in front of the tank. *See Figure* 4. The center target is used as the reference point and the crewman is required to lay on the reference point, zero the azimuth indicator and record the quadrant reading. From this reference point he determines data for targets 1 and 2. With this complete, the examiner announces fire commands that require the crewman to lay off the data for targets 3 and 4.

This test completely and thoroughly tests the crewman on the gunner's duties when firing with range cards. This is the only practicable application the crewman receives during the crewman's course. During the crew phase, the entire crew is tested on the techniques of range card firing.

Tables I-III (Subcaliber Firing Course)

The new crewman's course prescribes that the crewman will fire three subcaliber tables, all conducted at a range of 200 feet, using standard targets employed with the present tables. This administrative range setup makes these subcaliber tables very simple to conduct. Tests conducted by the U. S. Army Armor School have shown that all three tables can be fired easily in eight hours by a tank company.

In the development of these tables, emphasis was placed toward testing primary gunnery skills of obtaining first-round hits, the primary and alternate methods of adjustment and firing on moving targets. It was felt that the gunner skills tested in the present table II (manipulation exercise) could be easily integrated in other tables. In addition, the present manipulation exercise has been criticized by many Armor personnel in that this table tends to develop snap shooting, thus destroying the training emphasized in first-round hit exercises. Furthermore, rapid manipulation by the gunner is actually not a combat skill, as the tank commander normally acquires the target and

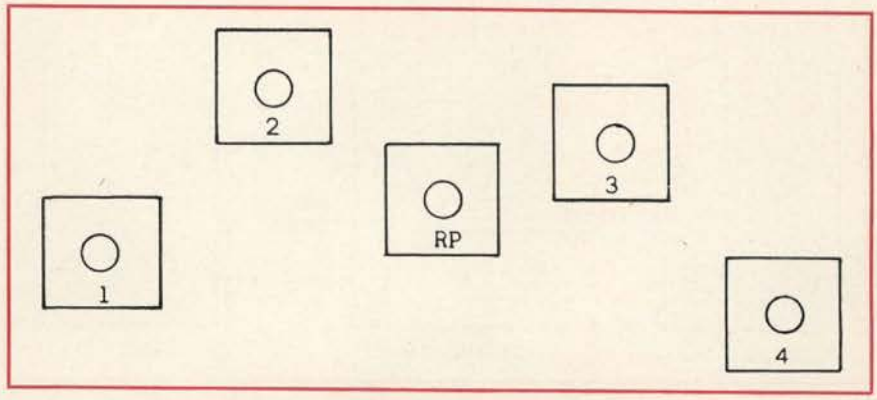


Figure 4. Target layout for range card.

lays the gun initially for direction. For these reasons the present table II has been deleted.

Gunner's skills necessary to employ the auxiliary fire control equipment can easily be tested without firing, and, as noted, are thoroughly tested in the present preliminary crewman's examination. As such, the present table IV (auxiliary fire control equipment exercise) has been eliminated from the crewman's course.

The new subcaliber exercises consist of the following tables and should be fired in numerical order to allow the gunner to progress gradually to more difficult gunner skills.

Table I—First-Round-Hit Exercise. The purpose of this exercise is to test the gunner's ability with the coaxial machine gun to lay and fire the tank gun with a correct sight picture prior to firing service ammunition. This exercise adequately tests the gunner's ability to assume the correct sight picture and make a precise lay with reasonable speed, thus requiring his actions to be deliberate. Further, it gives the gunner a limited amount of experience in manipulation of the gun controls.

To conduct the exercise, the gunner first zeros the primary and secondary sights with the coaxial machine gun on the zeroing silhouette. *See Figure 5.* Using his established zero, the gunner fires 10 rounds, one at each circle-type aiming point, alternating between the two silhouettes for each round, using the primary direct-fire sight. The gunner must complete the exercise in one minute.

During tests, a very high percentage of personnel qualified on this table, a fact that attests to the relative easiness of the exercise. Thus, as the initial exercise, it increases the individual's confidence in himself, thus encouraging him to continue to do well.

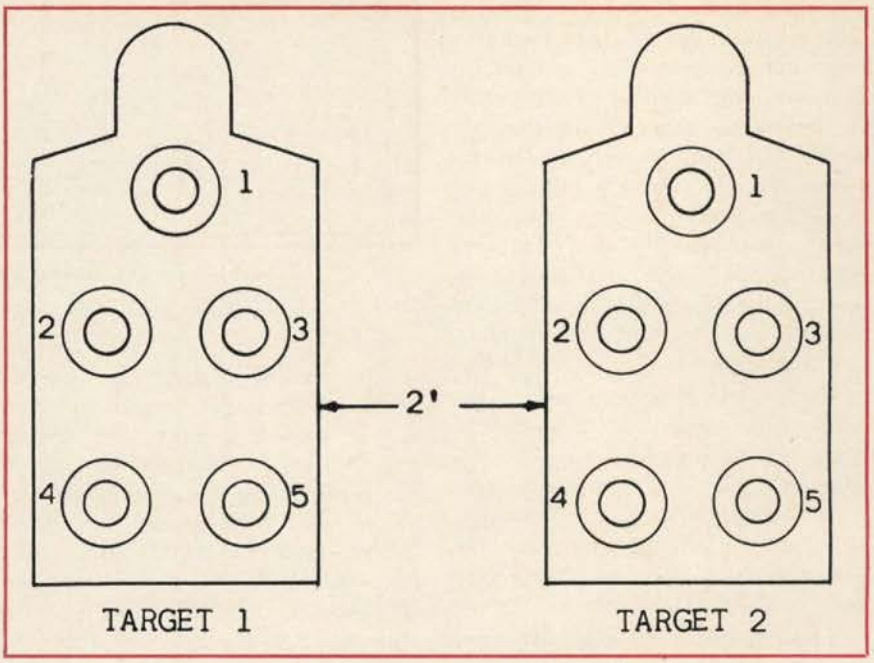


Figure 6. Target layout for table II.

Table II—Primary and Alternate Method of Adjustment Exercise. The purpose of this exercise is to test the gunner's ability to employ the primary and alternate methods of adjustment prior to firing service ammunition. This table is fired by the crewman immediately following table I with the zero established in that table. The gunner fires at two stationary targets with five circle-type aiming points on each target. These two targets should be placed adjacent to table I targets. At aiming points one-three on each target he will apply the primary method of adjustment with the primary sight. At aiming point four on each target he will apply the primary method of adjustment with the secondary sight. At aiming point five on each target he will apply the alternate method of adjustment using the primary sight. The gunner fires at all five aiming points in sequence as numbered on one target, and then engages the aiming points on the other target in the same manner. *See Figure 6.*

Table II, as is table I, is fired using ball ammunition; therefore, it is important that the gunner adjust the diopter of his sights so that he can see both the target and the sight reticle clearly. This diopter adjustment allows him to see the strike of the initial round, which is so necessary to employ the adjustments correctly.

In this exercise, the crewman is schooled in the methods of adjustment. Little difficulty has been encountered while administering this exercise to tested units and it is felt that upon completion the gunner more clearly understood the principles and procedures of adjusting tank fire.

Table III—Moving Target Exercise. Table III, with some modifications, is very similar to the present table III. As now, the table tests the gunner on his ability to hit a moving target with the caliber .30 machine gun prior to firing service ammunition. The target arrangement of the present table III is used to fire the exercise.

To conduct the new table the gun-

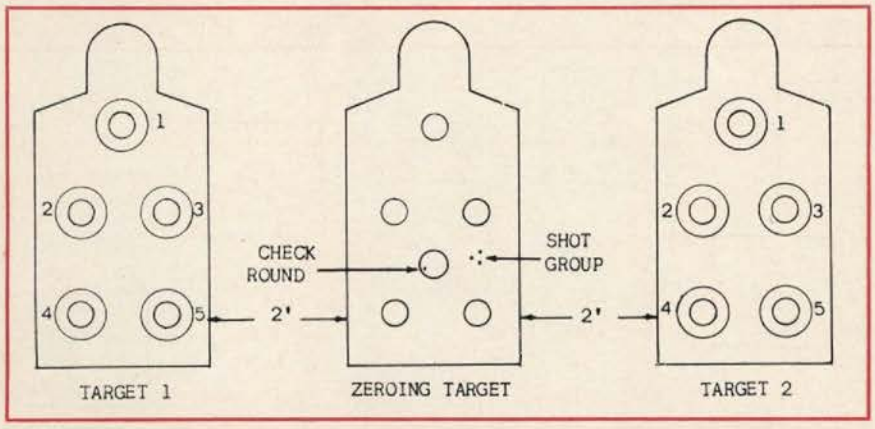


Figure 5. Target layout for first-round-hit exercise.

ner again has four trials. Only one, however, is in manual operation; three are in power. Thus the improved power system available in the M48A2 tank is emphasized. The gunner employs the primary sight during three engagements, the secondary sight for one engagement. A system of cutting the individual for improper tracking (ambushing) has been incorporated into the scoring.

Tables IV and V (Service Firing Course)

In the development of the new service tables, as in that of the subcaliber tables, emphasis was again directed toward testing and developing those gunner skills considered essential to combat; *i.e.*, adjusting fire on stationary and moving targets.

The boresighting and zeroing exercise (present table V) has been deleted from the course as boresighting and zeroing of the main gun is considered a crew operation and, as such, should not be one of the gunner skills tested in the firing phase of the crewman's qualification course. Cognizance, however, was given to the fact that an accurate boresight and zero are essential if a tank crew is expected to obtain all the desirable benefits available with the modern fire control equipment. This individual skill is adequately tested in test 6 of the crewman's preliminary examination. In addition, provisions are made in the course to allow the firing units to zero all tanks prior to firing the service tables. It would be desirable, but it is not mandatory, that the tank's assigned crew boresight and zero the weapon at this time.

The gunner's ability to employ the auxiliary fire control equipment presently tested in table VIII has been adequately tested in test 8 of the revised crewman's examination, and no additional skills could be tested by firing; thus table VIII of the present course has been deleted. The standard course now consists of two service tables as follows:

Table IV—Service Firing Exercise (Stationary Targets). This exercise is designed to test the gunner's ability to employ the primary method adjustment with both primary and secondary fire sights and employ the alternate method of adjustment with the primary fire sight firing service ammunition at stationary targets. The gunner is given two rounds (shot) to verify and if necessary refine the established zero for the gun prior to firing the scoring engagements. The gunner is allotted two rounds of ammunition for each engagement as shown in *Chart* 2.

Targets 1 and 2 are both engaged with the primary sight and require the employment of the primary method of adjustment with the second round. These targets are engaged with a range setting of 1,000 yards indexed in the fire control system and, as the targets vary in range between 800 and 1,000 yards, the initial round in most cases will just miss the target. This miss causes the gunner to employ burst-on-target for a second-round hit. The gunner is allowed 20 seconds to fire the two-round problem; therefore, emphasis must be placed on proper and rapid loading by the loader to ensure that the gunner is not penalized by the loader's action.

Target 3, which is placed at a range between 1,500 and 2,000 yards, is engaged with the primary sight, and is designed to test the gunner on employing the alternate method of adjustment. To conduct this problem the examiner induces a 200-yard range error into the system which causes the first round (simulated) to miss the target. The gunner simulates firing the initial round and announces LOST. The examiner now issues a subsequent fire command with a range correction, which, if correctly applied by the gunner, will cause the next round (first round fired) to hit the target. In the event the gunner misses the target with this round, he will apply the primary method of adjustment with a second round. This problem is a combat-realistic alternate method of adjustment problem and is quite simple to administer.

The final problem is fired at target 4 which is also at a range between 1,500 and 2,000 yards. This problem is conducted with the telescopic sight requiring the examiner to issue a fire command with a correct range element. If the first round is not a target hit, the gunner uses the burst-on-target method of adjustment to fire the subsequent round.

This table causes the gunner to demonstrate that he is basically proficient with both methods of adjustment; further, that he is required to employ both fire sights. In the initial development of this table it was felt that the crewman should be required to boresight the main gun and apply the established zero prior to firing the verifying rounds. This procedure was followed initially in the tests and the crewmen were able to boresight and fire the table in approximately 30-40 minutes. During tests, after the first few men had fired, heat waves in the tube would not allow crewmen to accomplish an accurate boresight. As a result, the boresight requirement has been deleted in the finished table. The table now can be conducted in approximately 20-30 minutes by a qualified examiner.

Table V—Service Firing Exercise (Moving Target). The purpose of this exercise is to test the ability of the gunner to hit a moving target with both sights employing, where necessary, the primary method of adjustment. The gunner, as in table IV, is again given two rounds to check and, if necessary, refine the established zero. The gunner then fires two rounds of shot ammunition at each of four moving targets, using the primary sight for the first three targets and the secondary sight

Target		Range in yards	No. of rounds	Sight	Possible points
Zeroing target	(6 x 6)	1500	2 (shot)	Primary	Unscored
1	(3 x 5)	800-1000	2 (shot)	Primary	25 points
2	(3 x 5)	1000-1200	2 (shot)	Primary	25 points
3	(6 x 6)	1500-2000	2 (HE)	Primary	25 points
4	(6 x 6)	1500-2000	2 (shot)	Secondary	25 points

Chart 2. Outline of exercise for table IV.

for the fourth target. Targets, as with the present table VII, are at ranges varying from 700 to 1,500 yards; thus present range facilities will still be adequate.

This table is similar to the present table VII; however, it has been modified to include employing both sights, timing the complete two-round engagement (20 seconds allowed) and a cut for improper tracking.

Summary: This course trains and tests the basic skills of the crewman as a gunner. As a result of this course, the crewman is classified as either expert, sharpshooter or marksman tank gunner. The crewmen that qualify on this course may be assigned as gunners of tank crews for the second phase, or tank crew gunnery qualification course.

Tank Crew Gunnery Qualification Course

The tank crew gunnery qualification course consists of tables VI, VIIA, VIIB, VIIIA and VIIIB. This course is designed to thoroughly train and test as crews the assigned tank crew members of TOE units. In development of the tank crew qualification course, it was determined that a test of night firing was required. Tables VIIB and VIIIB are night firing exercises in which range cards, tank-mounted searchlights, rifle flares, headlights and 4.2-inch-mortar illumination shells are used. Equal proficiency in night as well as day firing is therefore demanded.

Classification of tank crews as expert, sharpshooter or marksman is based on the combined scores made on tables VIIIA and VIIIB, which are day and night tank crew proficiency courses fired once for record.

In order to become proficient in all phases of crew firing, the tank crew must accomplish a period of crew training prior to these tests. Tables VI, VIIA and VIIB have been specifically designed to thoroughly prepare the crews for the two proficiency courses. These exercises are fired twice by each crew. The crew is not given a numerical score as a basis for the crew rating on these tables. Instead, the crew's actions and proficiency are evaluated by an examiner and the various techniques of target engagement are rated as either satisfactory or unsatisfactory. It should be realized that a tank crew cannot be expected to commence its crew firing and immediately be able to effectively fire the various problems. This is especially true in regard to night firing exercises. With this system of scoring, a crew that does poorly on table VI but continues to improve until a satisfactory score is achieved on the proficiency courses is not handicapped by this initial failure.

A commissioned officer is required to act as the examiner throughout the crew qualification course. There are several reasons for this. One is the fact that only a small number (2 or 3) are required to execute the course, and by keeping the potential examiners in a limited area more uniform standards will be maintained. Further, as a result of this close observation, immediate corrective action can be initiated to improve the affected crew's efficiency during these preliminary crew exercises.

The various exercises of the tank crew gunnery qualification course should be conducted over unimproved terrain to duplicate realism of normal cross-country firing and to keep expenditures to establish new ranges at a minimum. Imaginative armor commanders should find it relatively simple to establish these courses on existing range facilities.

Target realism, along with terrain realism, should be emphasized in the development of these courses. Gun simulators and moving and surprise targets should be used. Where possible, combat-type machine gun and antitank positions should be duplicated, consistent with available target material.

Initially, the crew should be composed of individuals who are normally assigned to the crew; however, as crew firing progresses commanders are authorized to vary the crew composition during tables VI, VIIA and VIIB. This gives the commander the opportunity to make final adjustments in the crew composition, thereby ensuring that the best balanced crews are matched for the crew proficiency courses. Crew composition will not be varied after the crew commences the crew proficiency courses.

The complete tank crew qualification course consists of the following tables and are fired in numerical sequence.

Table VI—Crew Moving Tank Machine Gun Exercise (Day). This is the first crew exercise fired by the tank crew and is designed to determine the crew's ability to engage various combat-type targets using both tank-mounted machine guns. This table is a proficiency-type exercise in which the crew is required to move the tank over the course and fire five consecutive problems as one firing exercise. The crew is given enough time to perform a thorough prepare-to-fire check, during which the caliber .50 and caliber .30 machine guns will be boresighted. A battle sight setting of 500 yards-HE ammunition is used, as this battle sight provides the gunner with the best initial data to engage the targets throughout the exercise. Further it keeps the initial burst near the target. Ammunition is stowed and communication is established before the exercise is conducted. The sequence may be varied to suit the available range facility. *See Chart* 3.

The exercise is conducted as follows:

Target 1: As the tank contacts the first target area on the course, the tank commander lays the gun and issues a fire command. The gunner fires approximately 50 rounds with the caliber .30 machine gun as the tank moves down the course, ceasing fire on order of the tank commander. Thus a typical small unit of infantry is easily brushed out of the way as a result of accurate machine gun fire. Time for this problem starts on sighting the target.

Target 2: The tank continues until contact is made with a machine gun target. As this is a small point target the tank commander must halt the tank and issue a fire command. The gunner fires approximately 50 rounds from the coaxial machine gun, ceasing fire on order of the tank commander. Time for this problem starts on command to halt the tank.

Target 3: The tank commander causes the tank to move out and upon sighting the moving truck target he halts the tank and issues a fire command. The gunner engages this target with approximately 50 rounds, ceasing fire on the tank commander's order. Time starts on the command to halt the tank. This target, because of its movement, re-

Target	Weapon	Range in yards	No. of rounds	Target description
1	Cal .30 MG	200	50	Infantry (4 E-type silhouettes)
2	Cal .30 MG	350	50	Machine gun (3 x 5-foot OD panel)
3	Cal .30 MG	400	50	Moving truck (7½ x 7½-foot OD panel)
4	Cal .30 MG	400	150	Infantry (15 F- and 5 E-type silhouettes)
5	Cal .50 MG	700	100	Stationary truck (6 x 6-foot OD panel)

Chart 3. Outline of exercise for table VI.

quires greater coordination between the tank commander and the gunner and thereby establishes preliminary habits that will later be used to engage moving targets with service ammunition.

Target 4: As the tank continues it will make contact with a large area infantry target. The tank commander must issue a fire command to engage the target, which the gunner engages with approximately 150 rounds as the tank continues to close with the target area. This target requires the gunner to manipulate his fire throughout the target area, and duplicates an assault situation in which the shock action of the machine gun is fully achieved.

Target 5: The tank commander will halt the tank at the end of the course. He then engages the truck target to his front with the caliber .50 machine gun from a stationary tank. One hundred rounds are fired at the target. This expenditure requires the tank commander to reload during the engagement. This is true on all caliber .50 problems as emphasis must be placed on the tank commander's ability to rapidly reload, an important prerequisite to successful night firing with the cupola-mounted machine gun.

The tank must maintain an average speed of 3-5 miles per hour. This speed gives the driver excellent experience and also immediately stresses his importance to the other crew members. He should be alert to warn the gunner of impending rough terrain and he should also control the speed of the tank to provide the gunner with as steady a platform as possible. Tank crews should not be allowed to hold fire until reaching a minimum range, as this action nullifies the training value and validity of the course.

This exercise is quite simple to set up and execute. Being the first crew exercise, it gives the crew a basic exercise to start with, which is logical in any training program. It duplicates typical machine gun problems, is fast moving, and quickly develops crew enthusiasm so necessary for further success.

Table VIIA—Crew Field Firing Exercise (Day). This exercise is a proficiency-type crew field firing exercise that develops and further tests the crew's ability to engage moving and stationary targets during daylight with all tank weapons.

The crew is required to have completed the crew moving tank machine gun exercise prior to firing this course. It is not necessary that the crew received satisfactory ratings on the machine gun exercise because the crew will continue to improve with each of the exercises. It is important, however, that errors made on the previous exercises are thoroughly critiqued and that definite steps are taken by commanders to ensure that adequate retraining is being accomplished to eliminate previous deficiencies.

To conduct this exercise the tank crew is allowed enough time to inspect its vehicle and perform the necessary prepare-to-fire check. All weapons are boresighted and the established zero is applied to the main gun. Appropriate boresight targets must be available to allow the crew the opportunity to accurately align the sights. Ammunition is stowed and communication is established with the control officer. During this preparatory phase of *all* crew exercises it is important that commanders allow the crews adequate time and, further, have available necessary administrative support in the form of supplies and trained mechanics to correct the determined deficiencies. Thus a secondary, but vital training, objective is incorporated in the exercise, that of developing in the crew an appreciation of the importance of maintenance and the necessity of compliance with correct operational procedures in maintaining and using the fire control and communication equipment. *See Chart 4.*

Once the tank is determined "ready," the crew moves over a course that requires it to fire seven consecutive problems as one firing exercise. The sequence may be varied to suit the available range facility.

The exercise is conducted as follows:

Target 1: The firing tank is ordered to move down the course and shortly the tank commander will observe the moving tank target. The tank is halted and the target is engaged with two rounds of shot using a battle sight setting of 1,000 yards-shot. The tank crew must open fire within 15 seconds after the command to halt the tank.

Target 2: The tank commander causes the tank to move out and another moving tank target is released. This target is engaged in the same manner as target 1.

Target 3: The tank continues down the course. The antitank target is designated and the tank is halted. The tank crew engages this target with two rounds of HE ammunition. This problem is a normal engagement that requires the range to be determined with the range finder. The crew must open fire within 25 seconds after the command to halt the tank.

Target 4: The tank continues along

Target	Weapon	Range in yards	No. of rounds	Target description	Sight
1	90-mm gun	1000-1200	2 (shot)	Moving tank (7½ x 7½-foot OD panel)	Primary with battlesight
2	90-mm gun	800-1000	2 (shot)	Moving tank (7½ x 7½-foot OD panel)	Primary with battlesight
3	90-mm gun	1500-2000	2 (HE)	Antitank (3 x 5-foot OD panel)	Primary
4	90-mm gun	1500-2000	2 (shot)	Stationary tank (7½ x 7½-foot OD panel)	Secondary
5	Cal .30 MG	200-400	100	Troops (10 E-type silhouettes)	Primary
6	90-mm gun	1200-1500	2 (HE)	Antitank (3 x 5-foot OD panel)	Primary
7	Cal .50 MG	1000-1500	100	Suspected area	Primary

Chart 4. Outline of exercise for table VIIA.

the course and the stationary tank target is designated. The tank crew engages this target with two rounds of shot ammunition. The gunner is required to use the secondary sight and the tank commander must estimate the range. The crew must open fire within 25 seconds.

Target 5: The target area is designated as the tank moves down the course. The tank engages this target with the caliber .30 machine gun while continuing to move down the course. The tank crew must open fire within 15 seconds after the tank commander identifies the target.

Target 6: The antitank target is designated and, after the tank is halted, this target is engaged with two rounds of HE ammunition. The tank commander is required to employ the range finder and the crew is allowed 25 seconds to open fire.

Target 7: The tank remains halted after target 6 and a suspected target area is designated to the tank commander, requiring him to make a reconnaissance by fire using the caliber .50 machine gun. The tank commander must open fire within 20 seconds after he identifies the target area.

To control the firing tank an examiner will ride with the firing tank and maintain communication with the tank crew. The examiner evaluates the individual problems according to the scoring table. *See Figure* 7.

Table VIIB—Crew Field Firing Exercise (Night). The purpose of this exercise is to determine the crew's ability to engage moving and stationary targets with all tank-mounted weapons at night. This exercise should be conducted over the same course as table VIIA, and, as the various problems are similar to table VIIA, only limited target preparation is required. Target illumination is provided by tank-mounted searchlights and 4.2-inch-mortar illuminating shells, both organic to all armor units. Night firing tests were conducted by the Armor School in November 1958 with the specific objective of developing a night firing phase for the gunnery qualification and, in addition, to determine the best techniques of employing the specific type of illumination being used. An effective range of 1,300 yards was obtained by the firing tank using illumination from an adjacent searchlight tank, which is the method used in this exercise. The control officer must be located on the searchlight tank where he can control the illumination and assist the examiner in evaluating the firing. The searchlight tank should not be positioned closer than 40 yards to the firing tank as any closer distance will produce excessive glare in the direct-fire sights of the firing tank. A tank crew is able to sense and adjust fire from all tank weapons using adjacent searchlight illumination. Flicker illumination is used on stationary targets; however, on moving targets, continuous illumination must be used as the target is lost when flicker illumination is employed. The most effective method of flicker illumination is 15 seconds on and five seconds off.

When the 4.2-inch illuminating shells are being used for illumination, three rounds should be fired with no less than five and not more than 10 seconds between rounds. This is the minimum amount of illumination that can be used and still allow the crew to engage the target. Illuminating shells will be more effective when fired so that they completely burn out before contact with the ground. Flares burning in the target area produce excessive glare in the direct-fire sights. Targets engaged with mortar illumination are beyond 1,500 yards, as this type of illumination is not desirable at ranges closer than 1,500 yards. At closer ranges the flare produces excessive glare in the direct-fire sights.

The range finder is not used for ranging in the night firing exercises, as the types of illumination being used do not have sufficient intensity to allow ranging.

Glare from the lighting devices in standard M48 tanks must be considered prior to night firing. The gunner's vision will be affected by glare from the gun-ready lights, gunner's switchbox lights and computer scale lights. The tank commander's vision will be affected by glare from the loader's safety light, cupola loading light and range scale lights. Prior to night firing, the crew should either remove or cover all these lights, which requires that the crew be able to function in a completely blacked-out turret. Whenever the auxiliary fire control instruments are used a partially covered flashlight will provide adequate illumination.

To conduct this exercise the tank crew inspects its vehicle and equipment. Ammunition is stowed and communication is established with the control officer. A battle sight setting of 1,000-yards-shot ammunition is used. The tank crew will move onto the course on order of the control officer and fire seven consecutive problems as one firing exercise. The sequence may be varied to suit the available range facility. *See Chart* 5.

UNIT_____ TANK CREW_____

COMMANDER_____

GUNNER_____

DATE_____ LOADER_____

DRIVER_____

TANK CREW GUNNERY QUALIFICATION SCORE CARD

TABLE VIIA–CREW FIELD FIRING EXERCISE (DAY)

TARGET	NUMBER OF ROUNDS	ITEM	SAT	UNSAT
1 Moving Tank	2 Shot	Initial fire command.....	.....	.....
		Opened fire in 15 seconds..	.....	.....
		Target effect.....	.....	.....
2 Moving Tank	2 Shot	Initial fire command.....	.....	.....
		Opened fire in 15 seconds..	.....	.....
		Target effect.....	.....	.....
3 Antitank	2 HE	Initial fire command.....	.....	.....
		Opened fire in 25 seconds..	.....	.....
		Target effect.....	.....	.....
4 Stationary Tank	2 Shot	Initial fire command.....	.....	.....
		Opened fire in 25 seconds..	.....	.....
		Target effect.....	.....	.....
5 Troops	100 Cal .30	Initial fire command.....	.....	.....
		Opened fire in 15 seconds..	.....	.....
		Method of fire.....	.....	.....
		Target effect.....	.....	.....
6 Antitank	2 HE	Initial fire command.....	.....	.....
		Opened fire in 25 seconds..	.....	.....
		Target effect.....	.....	.....
7 Suspected Area	100 Cal .50	Opened fire in 20 seconds..	.....	.....
		Method of fire.....	.....	.....
		Target effect.....	.....	.....

Examiner's Remarks: _____

_____

_____

_____

_____

Examining Officer's Signature

Figure 7. Score card for table VIIA.

The exercise is conducted as follows:

Target 1 (range card): The tank crew occupies a prepared position. A range card, prepared by the control tank crew, is given to the tank commander of the firing tank. The tank crew is required to engage a target using range card data as designated by the examiner.

Target 2 (moving tank): The control officer orders the firing tank to move down the course. The control tank searchlight illuminates the moving target with steady illumination. The firing tank halts and engages the moving target with two rounds of shot. The searchlight is turned off after the last round is fired and the firing tank moves down the course.

Target 3 (moving tank): The control tank searchlight illuminates the moving target with steady illumination. The firing tank halts and engages the moving target with two rounds of shot. The searchlight is turned off after the last round and the firing tank moves down the course.

Target 4 (troops): The control tank searchlight illuminates this target with flicker illumination. The firing tank engages the target with the caliber .30 machine gun while continuing to move down the course.

Target 5 (antitank): The control tank searchlight illuminates the target with flicker illumination. The firing tank halts and engages this target with three rounds of HE ammunition. The searchlight is turned off after the last round is fired and the tanks continue moving down the course.

Target 6 (troops): The control tank searchlight illuminates the target with flicker illumination. The firing tank halts and engages this target with the caliber .50 machine gun. The searchlight is turned off at the completion of firing. The tank remains halted for the conduct of problem 7.

Target 7 (stationary tank): The tank commander is informed of an enemy location beyond tank-mounted searchlight range. The control officer requests 4.2-inch mortar illumination. The target is illuminated by three 4.2-inch-mortar illuminating shells and the tank crew engages the target with three rounds of shot ammunition. All weapons are cleared and the tank returns to the assembly area.

As previously mentioned, the control officer will ride a tank equipped with a tank-mounted searchlight that must be boresighted. Radio communication will be maintained between the control officer and the examiner; however, flashlight signals are recommended as a means to keep radio traffic at a minimum.

To evaluate all night firing, the examiner should observe the actions of the tank crew in engaging the target. In addition, the control officer should be used to score the target effect by using the control tank direct-fire sights and binocular. The individual problems are then scored by use of a score card similar to that used for table VIIA.

Target	Weapon	Range in yards	No. of rounds	Target description	Method of illumination
1	90-mm gun	1500-2000	1 (HE)	Troops (6 x 6-foot OD panel and 8 silhouettes)	None (range card)
2	90-mm gun	1000-1200	2 (shot)	Moving tank (7½ x 7½-foot OD panel)	Adjacent tank searchlight—steady illumination
3	90-mm gun	800-1000	2 (shot)	Moving tank (7½ x 7½-foot OD panel)	Adjacent tank searchlight—steady illumination
4	Cal .30 MG	400-800	100	Troops (10 silhouettes)	Adjacent tank searchlight—flicker illumination
5	90-mm gun	1000-1200	3 (HE)	Antitank (6 x 6-foot OD panel)	Adjacent tank searchlight—flicker illumination
6	Cal .50 MG	1000-1200	100	Troops (10 silhouettes)	Adjacent tank searchlight—flicker illumination
7	90-mm gun	1500-2000	3 (shot)	Stationary tank (6 x 6-foot OD panel)	3 rounds of 4.2-inch mortar illuminating shell

Chart 5. Outline of exercise for table VIIB.

Qualification Firing

The tank crew proficiency exercises (tables VIIIA and VIIIB) are the culmination of all previous gunnery training. They are designed to develop and test crew proficiency in gunnery and are the basis for the crew's qualification.

The possible score for both exercises is 2,000 points and the qualifying score is 1,200 points. This scoring is based on the total number of targets hit, method of fire, initial fire commands, opening and completing fire within prescribed time limits and crew performance of duties. Each table has a possible score of 1,000 points; however, as a crew must be proficient in both day and night operation, a minimum score of 600 points must be made on each course before the scores can be combined for a crew rating. Thus a crew that does poorly during the night exercise (less than 600 points) could not be considered qualified, even if it did extremely well on the day course and the combined score was above 1,200 points. This system of scoring emphasizes complete crew proficiency and places night firing in its true importance.

Based on the combined scores the crew will receive a classification as shown in the following table:

Crew Classification	Classification Score
Expert crew	1,800 points
Sharpshooter crew	1,500 points
Marksman crew	1,200 points
Unqualified	1,199 and less

Each crew should use its own tank to fire the course and sufficient time must be allowed before each test to allow the crew to perform a complete prepare-to-fire check. When a crew announces that it is ready, the guns and tank are assumed to be in operating condition. Retests will not be given to those crews whose tanks or guns fail to function properly, unless the officer in charge feels the firing was affected by circumstances beyond their control. There should be no dry or practice runs before the record trials. The length of the courses should be at least 1,500 yards. All targets should be surprise in nature and, depending on the materials available, they should be activated by employing demolitions, movement into view, or pop-up techniques.

The exercises will be controlled by an officer who will follow the firing tank in another vehicle. During the night exercise the control officer must use a searchlight tank. The examining officer may and should assist the control officer as required.

All targets must be physically scored for hits by scoring personnel. Time for each problem on the daylight exercise commences when the target is identified by the tank commander. Time for each problem on the night exercise commences when the target is illuminated by the control officer. The examiner on the firing tank determines, through experience, when these conditions exist and begins timing at that point.

Table VIIIA—Crew Proficiency Course (Day). The purpose of this exercise is to test the crew's ability to engage moving and stationary targets with all tank weapons during daylight. The sequence of the problems may be varied to fit the available range facility. *See Chart 6.*

The course is conducted as follows:

Problem 1 (troops): The tank moves from the assembly area. The tank commander observes the target. The tank crew engages this target with the caliber .30 machine gun while moving down the course.

Problem 2 (troops): The tank commander observes the target. The tank crew engages the target with the caliber .30 machine gun. The tank continues moving during the problem.

Problem 3 (reconnaissance by fire): The general area of a suspected target will be pointed out to the tank commander. The tank is halted and the target is engaged using the caliber .50 machine gun. Upon completion of this problem the tank crew will be instructed to continue down the course.

Problem 4 (troops): The tank commander observes the target. This

Target	Weapon	Range in yards	No. of rounds	Target description
1	Cal .30 MG	200-400	75	Troops (10 E-type silhouettes)
2	Cal .30 MG	300-500	75	Troops (5 E-type silhouettes)
3	Cal .50 MG	1000-1300	50	Suspected area
4	Cal .30 MG	500-600	75	Troops (10 E-type silhouettes)
5	90-mm gun	1000-1200	2 (HE)	Antitank (3 x 5-foot OD panel)
6	90-mm gun	1000	2 (shot)	Moving tank (7½ x 7½-foot foot OD panel)
7	Cal .50 MG	1000	50	Recon vehicle (7½ x 7½-foot OD panel)
8	Cal .30 MG	500-800	75	Moving truck (7½ x 7½-foot OD panel)
9	90-mm gun	900-1100	2 (HE)	Antitank (3 x 5-foot OD panel)

Chart 6. Outline of exercise for table VIIIA.

target is then engaged using the caliber .30 machine gun while continuing down the course.

Problem 5 (antitank): The tank commander sees a flash that represents an antitank gun firing at his tank. The tank is halted and this target is engaged with two rounds of HE ammunition. Upon completion of this problem the tank continues moving down the course.

Problem 6 (moving tank): The control officer orders the release of the moving target. The tank is halted and the crew engages this target with two rounds of shot ammunition.

Problem 7 (stationary vehicle): The commander observes the target. The tank commander will engage this target using the caliber .50 machine gun. The tank moves out upon completion of this problem.

Problem 8 (moving truck): The control officer orders the release of the moving target. The tank is halted and engages the target using the caliber .30 machine gun.

Problem 9 (antitank): The tank moves out, and the tank commander sees a flash representing an antitank gun firing at the tank. The tank is halted and the target is engaged with two rounds of HE ammunition. The guns are cleared and the tank returns to the starting point.

The individual problems are scored as shown in *Figure 8.*

Table VIIIB—Crew Proficiency Course (Night). The purpose of this course is to test the crew's ability to engage moving and stationary targets with all tank weapons at night. It is fired once for record after the crew has completed the day course. The sequence of the problems may be varied; however, the problems included in the course are as shown in *Chart 7.*

The course is conducted as follows:

Problem 1 (troops): The firing tank moves from the assembly area. A rifle flare is fired to mark the target area. The tank crew engages the target using the caliber .30 machine gun while moving down the course.

Problem 2 (troops): A demolition charge is fired in the target area. The firing tank engages the target using the caliber .30 machine gun and turns on the vehicle headlights for target illumination. The tank continues moving during the problem.

Problem 3 (troops): The control tank searchlight illuminates the target and the firing tank halts. The firing tank engages the target using the caliber .50 machine gun. The control tank employs flicker illumination. At completion of firing, the tanks continue moving down the course.

Problem 4 (troops): The control tank searchlight illuminates the target by flicker illumination. The firing tank engages the target using the caliber .30 machine gun while continuing to move down the course.

Problem 5 (antitank): The firing tank is halted by the examiner and the tank commander is informed of an antitank gun location. The control officer requests mortar illumination. The 4.2-inch mortars fire a three-round pattern and the firing tank engages the target with three rounds of HE ammunition. Tanks continue moving down the course after burnout of the mortar shells.

Problem 6 (moving tank): The control officer orders the release of the moving target. The control tank searchlight illuminates the moving target by steady illumination. The firing tank halts and engages the target with two rounds of shot ammunition. The firing tank remains halted.

Problem 7 (stationary vehicle): The control tank searchlight illuminates the target by flicker illumination. The tank commander engages the target using the caliber .50 machine gun. The searchlight is turned off at the completion of this problem and the tanks continue moving down the course.

Problem 8 (moving truck): The control officer orders the release of the moving target. The control tank searchlight illuminates the moving target by steady illumination. The firing tank halts and engages the target using the caliber .30 machine gun. The searchlight is turned off and the tanks continue down the course.

Problem 9 (antitank): The control tank searchlight illuminates the target by flicker illumination. The firing tank halts and engages the target with three rounds of HE am-

munition. All weapons are cleared and the tanks return to the starting point.

Figure 9 shows the score card for this exercise.

Conclusion

Armor commanders have long realized that qualification of individuals in only firing duties does not indicate that a combat-ready crew has been developed. Commanders have developed and fired various crew exercises designed to further train their personnel as coordinated tank crews. The amount of importance placed on these crew exercises depended largely on the commander and facilities available. The new tank gunner qualification course, at long last, gives Armor a standard means of training and testing its personnel as tank crews, and makes Armor the first arm to insist on proficiency in night firing as a basis for annual qualification.

UNIT_____ TANK CREW_____
COMMANDER_____
GUNNER_____
DATE_____ LOADER_____
DRIVER_____
SCORE_____

TANK CREW GUNNERY QUALIFICATION SCORE CARD

TABLE VIIIA–CREW PROFICIENCY COURSE (DAY)

TARGET	NUMBER OF ROUNDS	ITEM	POSSIBLE	POINTS MADE	TOTAL
1 Troops	100 Cal .30	10 for each target hit up to five targets 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire	100	.... TOTAL	.....
2 Troops	100 Cal .30	10 for each target hit up to three targets 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire	80	.... TOTAL	.....
3 Suspected Area	50 Cal .50	35 for getting into target area 10 for proper method of fire	45	.... TOTAL	.....
4 Troops	100 Cal .30	10 for each target hit up to five targets 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire	100	.... TOTAL	.....
5 Antitank	2 HE	90 for getting target hit 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 20 for completing fire in 30 seconds	150	.... TOTAL	.....
6 Moving Tank	2 Shot	100 for hitting target 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 20 for proper tracking	160	.... TOTAL	.....
7 Vehicle	50 Cal .50	35 for getting into target area 10 for proper method of fire	45	.... TOTAL	.....
8 Moving Truck	100 Cal .30	10 for each target hit up to 10 hits 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire 20 for proper tracking	170	.... TOTAL	.....
9 Antitank	2	90 for hitting target 20 for opening fire in 15 seconds 5 for initial fire command 15 for crew duties 20 for completing fire in 30 seconds	150	.... TOTAL	.....
				EXERCISE TOTAL	

NOTE: Minimum qualifying score for combining with table VIIIB is 600 points.

Examiner_____ Officer in Charge_____

Figure 8. Score card for table VIIIA.

Target	Weapon	Range in yards	No. of rounds	Target description	Method of illumination
1	Cal .30 MG	200-400	100	Troops (10 silhouettes)	Rifle flare
2	Cal .30 MG	200-300	100	Troops (5 silhouettes)	Demolitions and vehicle headlights
3	Cal .50 MG	1000-1300	50	Troops (10 silhouettes)	Adjacent tank searchlight—flicker illumination
4	Cal .30 MG	400-600	100	Troops (10 silhouettes)	Adjacent tank searchlight—flicker illumination
5	90-mm gun	1000	3 (HE)	Antitank (6 x 6-foot OD panel)	3 rounds 4.2-inch mortar illuminating shell
6	90-mm gun	1000	2 (shot)	Moving tank (7½ x 7½-foot OD panel)	Adjacent tank searchlight—steady illumination
7	Cal .50 MG	800-1000	50	Stationary vehicle (7½ x 7½-foot OD panel)	Adjacent tank searchlight—flicker illumination
8	Cal .30 MG	600-800	100	Moving truck (7½ x 7½-foot OD panel)	Adjacent tank searchlight—steady illumination
9	90-mm gun	900-1100	3 (HE)	Antitank (6 x 6-foot OD panel)	Adjacent tank searchlight—flicker illumination

Chart 7. Outline of exercise for table VIIIB.

UNIT_____ TANK CREW_____
COMMANDER_____
GUNNER_____
DATE_____ LOADER_____
DRIVER_____
SCORE_____

TANK CREW GUNNERY QUALIFICATION SCORE CARD

TABLE VIIIB–CREW PROFICIENCY COURSE (NIGHT)

TARGET	NUMBER OF ROUNDS	ITEM	POSSIBLE	POINTS MADE	TOTAL
1 Troops	100 Cal .30	10 for each target hit up to five targets 20 for opening fire in 25 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire	100	.... TOTAL	.....
2 Troops	100 Cal .30	10 for each target hit up to three targets 20 for opening fire in 25 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire	80	.... TOTAL	.....
3 Troops	50 Cal .50	35 for getting into target area 10 for proper method of fire	45	.... TOTAL	.....
4 Troops	100 Cal .30	10 for each target hit up to five targets 20 for opening fire in 25 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire	100	.... TOTAL	.....
5 Antitank	3 HE	90 for hitting target 20 for opening fire in 30 seconds 5 for initial fire command 15 for crew duties 20 for completing fire in 45 seconds	150	.... TOTAL	.....
6 Moving Tank	2 Shot	100 for hitting target 20 for opening fire in 30 seconds 5 for initial fire command 15 for crew duties 20 for proper tracking	160	.... TOTAL	.....
7 Vehicle	50 Cal .30	35 for getting into target area 10 for proper method of fire	45	.... TOTAL	.....
8 Moving Truck	100 Cal .30	10 for each target hit up to 10 hits 20 for opening fire in 25 seconds 5 for initial fire command 15 for crew duties 10 for proper method of fire 20 for proper tracking	170	.... TOTAL	.....
9 Antitank	3 HE	90 for hitting target 20 for opening fire in 30 seconds 5 for initial fire command 15 for crew duties 20 for completing fire in 45 seconds	150	.... TOTAL	.....
				EXERCISE TOTAL	

NOTE: Minimum qualifying score for combining with table VIIIA is 600 points.

Examiner_____ Officer in Charge_____

Figure 9. Score card for table VIIIB.

Pictorial History of Armor

By LIEUTENANT COLONEL ROBERT B. RIGG

THE ancestry of Armor began with the war elephant and combat chariot—which were the earliest military vehicles embracing shock action. While the modern tank is a product of the 20th Century, tank concepts, imagined or built, date back hundreds of years. Man has long been in quest of the vehicular means to wage war with a device embracing firepower, mobility and protection. Harnessing horses or seeking to harness the wind for a land battleship, the early vehicular quests were for mobility, protection and firepower, roughly in that order. For example, in Italy a man named Valturio proposed a windmill and wheel geared chariot in 1472. The mechanical genius and artistry of Leonardo da Vinci suggested swirling scythes as a means of cutting swaths through enemy ranks. But the horse was before the cart, and his sickle chariot had practical deficiencies, despite the armor protection it afforded the soldier-driver. The armored medieval knight proved for a long period to be the most practicable means of shock action with protection. In ancestry then, the tank was in the minds of men, but the technology of the early times was inadequate to the extent that nobody could replace the horse or man as a means of propulsion.

With the invention of the steam engine man's hope for a self-propelled battle wagon had new foundation. And in the 19th Century, some men examined land locomotion and were daring enough in concept to examine the wheel and even embellish its principle with articulation. The French engineer, Nicola Joseph Kuno, had constructed a steam automobile in 1769. Crude and imperfect, his machine might have furthered earlier military adaptation of the self-powered vehicle, had it not been for an accident. When Kuno's car was undergoing test demonstration before authorities, it careened and plowed into a house, destroying the dwelling. Kuno was thus put in prison for "disturbing the peace"—and in a way a measure of progress ground to a halt.

However, the terrestrial track laying engine was conceived by a fellow Englishman, Richard Edgeworth, a year after Kuno had demonstrated his vehicle.

In the Crimean Campaign the British Army used Boydell's steam tractor about 1856. By virtue of its good cross country ability this machine attracted the attention of military men. After the war the British Army conducted tests with this tractor and wagon trailers, loading the latter with armed troops and hauling them about Hyde Park at six mph. But new ideas take root slowly.

Probably influenced by the British, the Russians put some steam tractors to work drawing artillery in the Russo-Turkish war in 1877-78. None was directly in combat, however.

As late as 1885 the "mow the enemy down with sickles" concept was still alive but technology was not equal to the task.

In the end, the steam engine proved too bulky and unreliable for military application. The tank had to wait on the automobile and the latter had to wait for the internal combustion engine. Once adapted to the car, this engine was applied to the tractor. By 1913 there were thousands of tractors in use in the United States. Thus, the foundation of mechanical mobility was established for the tank. Thanks to technology and naval efforts, steel armor had been improved and the armored combat vehicle was around the corner.

In the decades preceding World War I the first real tank projects and concepts began to emerge. According to the Soviets, Russian engineer V. Mendeleev, in 1911, submitted to Tsarist military authorities a concept of an armored vehicle with caterpillar motion. The Russian generals replied "nyet." In 1913 an Austrian officer and an unknown British plumber reportedly petitioned their military ministries with a tank concept. But these proposals, however good or bad, gathered administrative moss and even engendered criticism. Early in the century preceding this date a parallel response had slapped the faces of inventors and gadgeteers who had sought to sell the balloon to the American military.

In 1912 an Englishman by the name of De Mol presented a "tank" invention or concept which "anticipated and in certain respects surpassed the 1916 tank,"—this is the quoted evaluation of the British committee which in 1919 examined the question of precedence in the invention of the tank.

In Berlin a "tank" was attacked by a mob throwing stones at it in 1913. Herr Hebel, an inventor, gave a paid exhibition of his "tank" widely advertising it as a dreadful invention bristling with armament. However, reportedly climbing a 30 degree slope, his vehicle stalled and stuck in place. The public wanted its money back and pelted the unfortunate inventor.

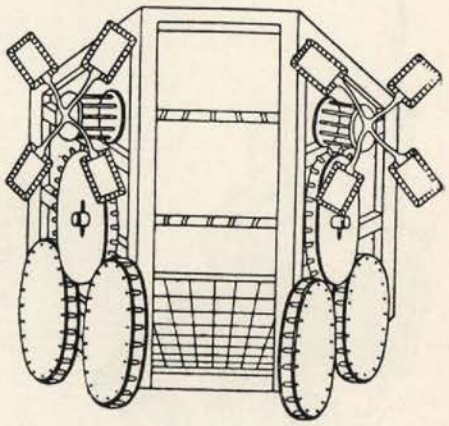
As in the case of many mechanical and matériel instruments of combat, war itself was to speed their creation and development.

The illustrations which follow give graphic presentation of the quest for, and development of, the tank from the early ages, up through World War II.

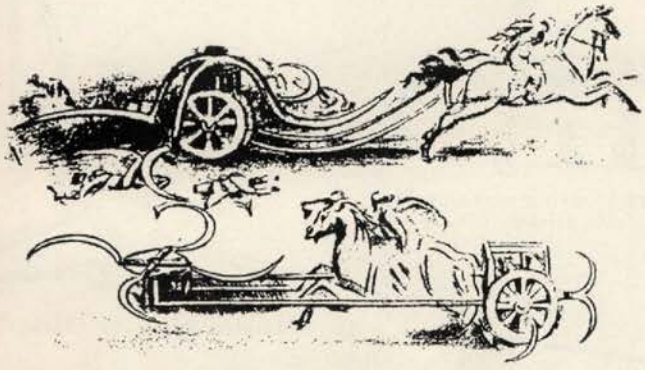
1. Assyrian armored war chariots.

2. Carthaginian war elephants.

3. Scotch wooden wheeled war transport (1456).



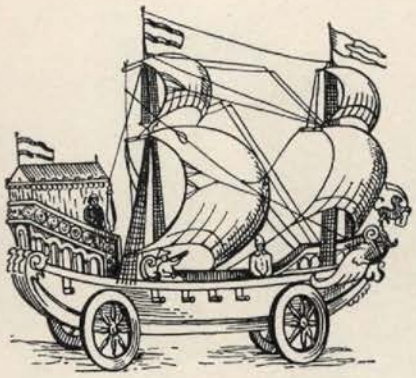
4. Wind chariot. A concept by an Italian named Valturio to propel a chariot by windmill vanes (1472).



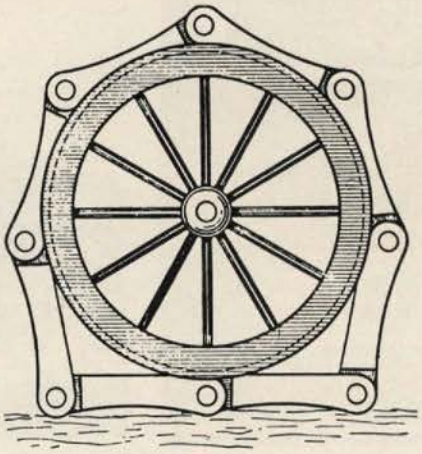
5. Sickle-wheeled scythe chariot by Leonardo da Vinci (1500).

6. The walking fortress, a German concept by Holschuer of an artillery armed mobile military city (1558).

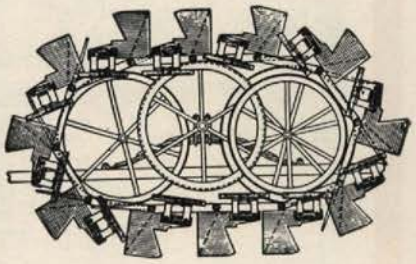
7. Sailing battle vehicles of August Rommeli (1588).



8. Terrestrial gunboat, a concept by the Dutchman, Simon Steven (1599).

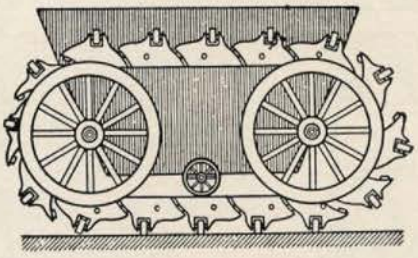


11. Louis Gompers' track mobile wheel for soft ground (1831).

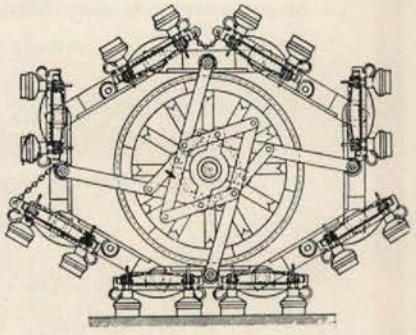


14. The improved transferable railroad, a concept by James Welch (1857).

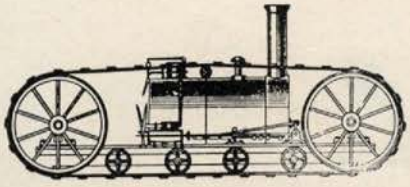
9. Medieval armored knights.



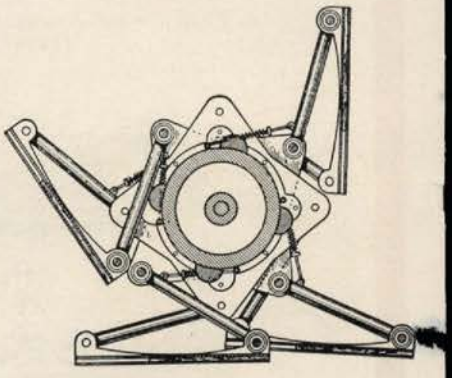
12. The universal railroad by English inventor George Kale (1825).



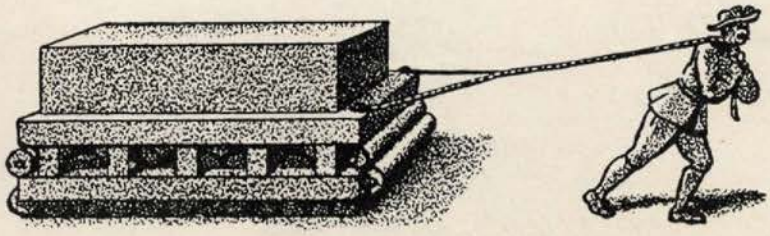
15. The walking wheel by Dunlop (1861).

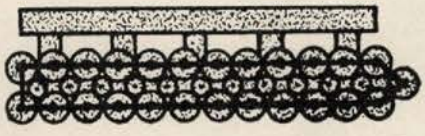


13. The first track laying machine by Englishman John Gitkot (1832).

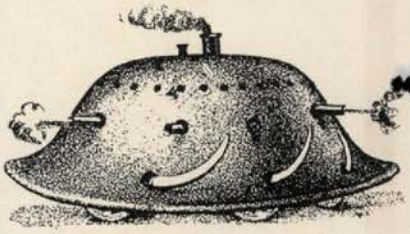


16. Animated wheel by Clark (1891).

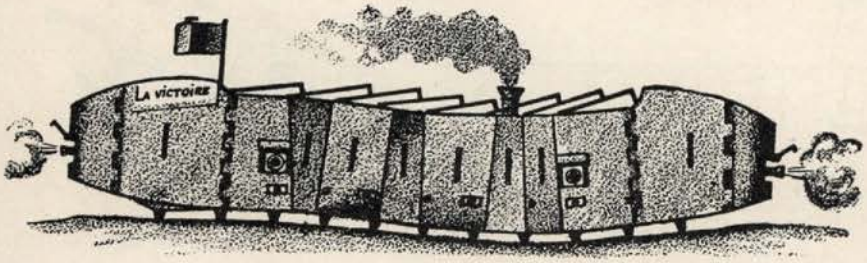




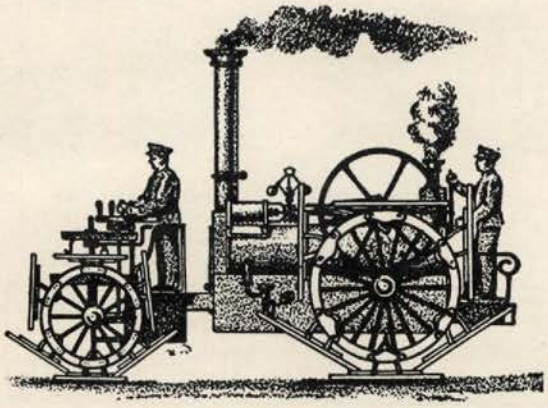
10. D'Erman plan: "a vehicle . . . for decreasing friction," presented in the French Academy of Sciences (1713).



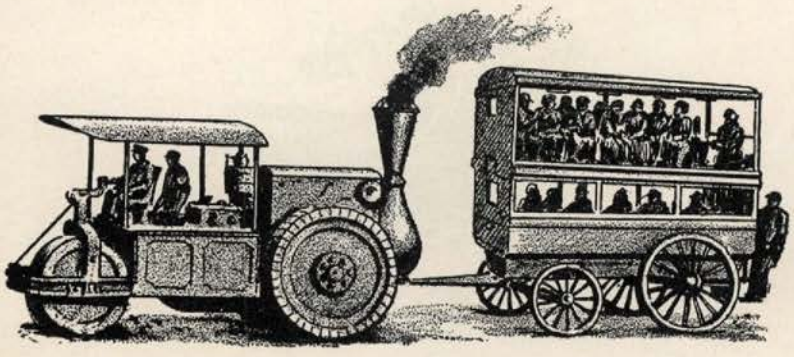
17. The armored battle wagon, a concept proposed to the British military by James Cowan (1855).



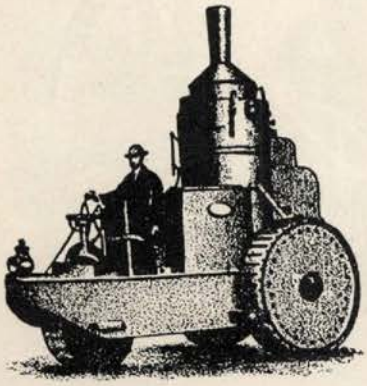
18. The armed train of Bouen with 12 cannon, 4 mitrailleuses, and 200 men. This concept was patented but it was never built (1874).



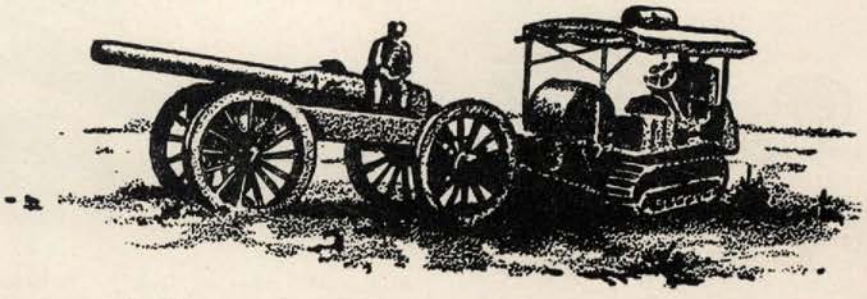
19. Boydell steam tractor, militarily used by the British in the Crimean Campaign, and later tested as a troop transport wagon (1858).



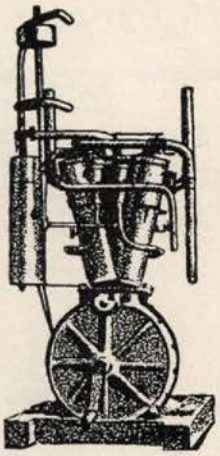
20. The English Burrell tractor with omnibus (1871).



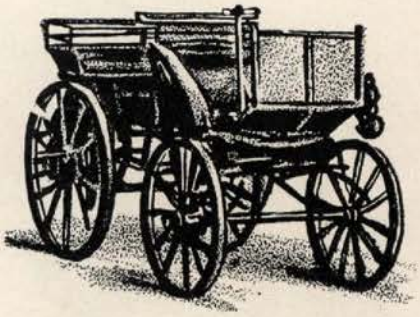
21. Another Burrell tractor, reportedly used to draw artillery in France but it was not used in direct combat.



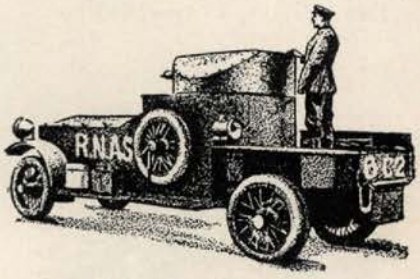
22. The American Holt tractor used in France (1914).



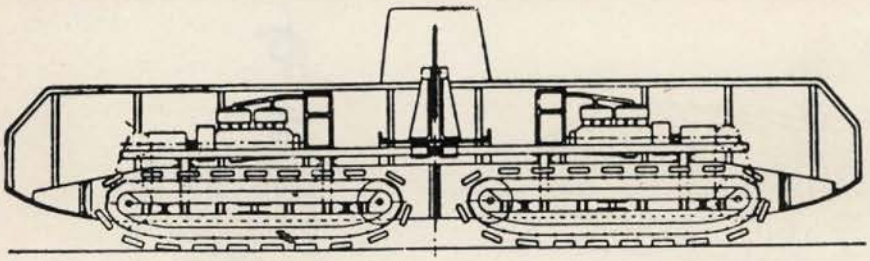
23. The first German Daimler internal combustion engine for cars.



24. First Daimler automobile with internal combustion engine (1886).

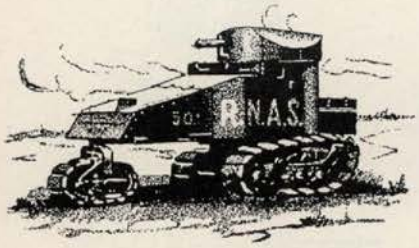


25. WW I British armored car. The RNAS or Royal Naval Aviation Service used these for guarding airfields.



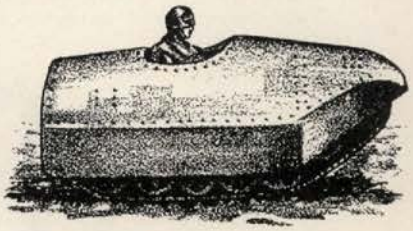
26. First project of the British Sueter tank (1915).

34. French St. Chamond tank (1916).

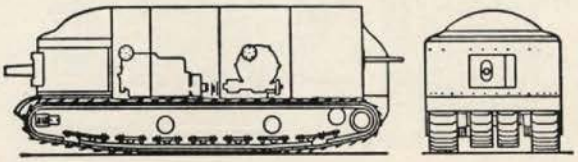


27. First experimental armored track laying machine.

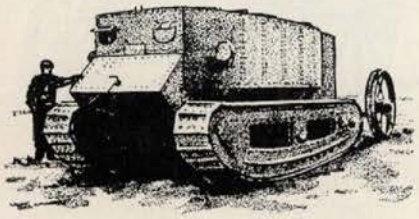
31. M1 tank, Female, six machine guns (1916).



35. First Russian tank, by Porokhovshchikov (tested June 1915).

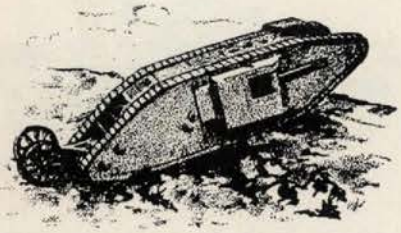


32. British Flying Elephant tank, a concept for a 100 ton tank with supplementary tracks under the belly (1916).

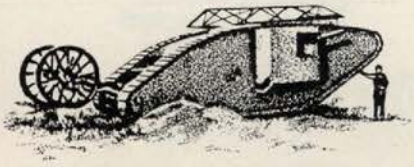


28. An initial experimental model of the British tank, tested September 1915 (weight: 18 tons; 105 hp).

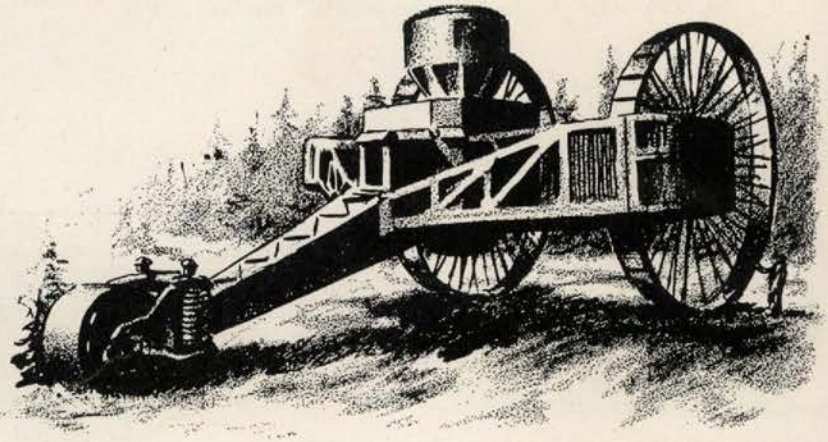
33. First French Schneider tank. One 75mm gun or two machine guns; crew: six men; weight: 13.5 tons (1916).



29. The Big Willie, a prototype of the first M1 British tanks.

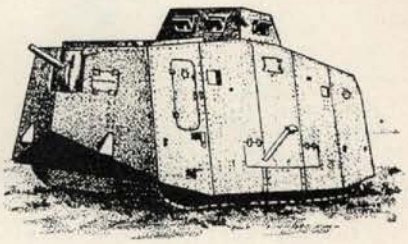


30. M1 tank Male, weight: 28 tons; crew: eight men; two 57mm guns and four machine guns (1916).

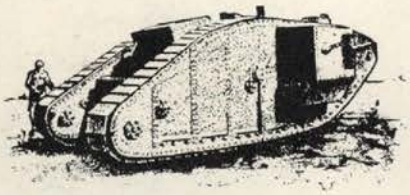


36. Russian wheeled tank by Lebedenko. Design may have been influenced by Caucasian bullock carts (tested August 1915).

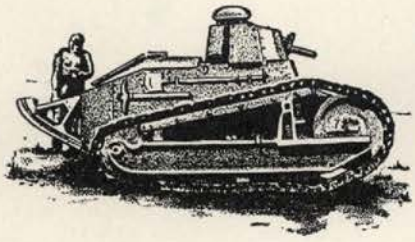
37. Attack by British tanks on the Somme (15 September 1916).



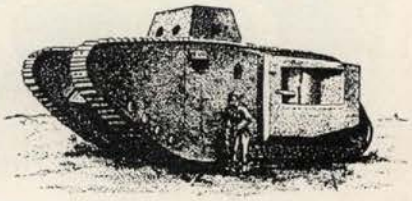
46. German A7V tank (1918).



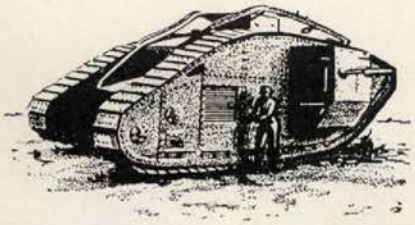
38. British MIV tank, without tail.



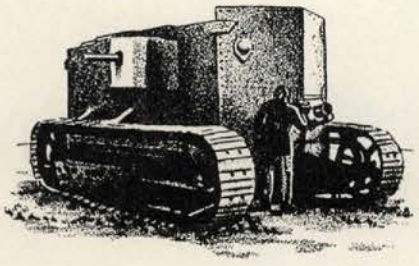
42. French light Renault tank (1918).



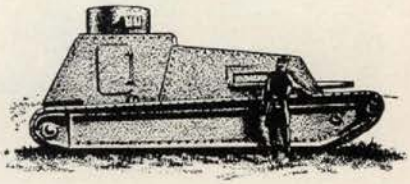
47. German heavy A7VU tank (1918).



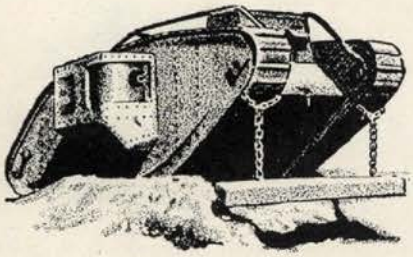
39. British MV tank (last released during WW I) with single stage planetary turning mechanism (1918).



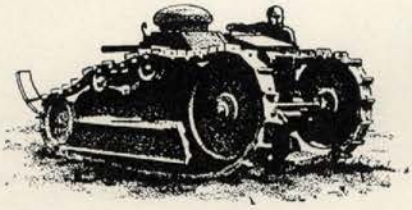
43. U. S. experimental gas-electric tank, constructed jointly by Holt and General Electric (1918).



48. German light tank LKI (1918).



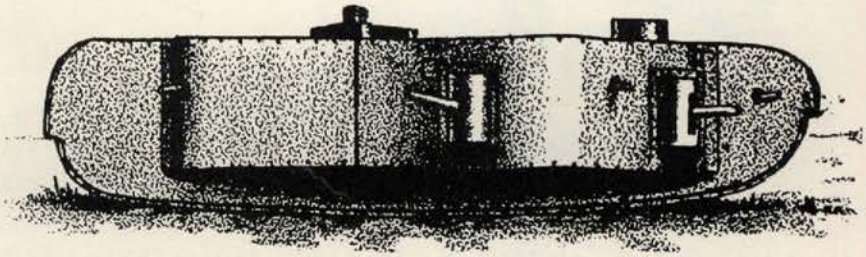
40. British attachment to the front of the tank; World War I.



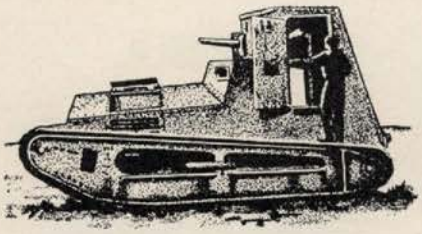
44. U. S. experimental Ford tank (1918).

49. Rear view of German Mark K tank.

41. British Whippet tank (1917).

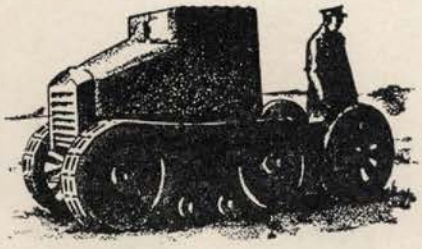


45. German super heavy Mark K tank; weight: 150 tons (1918).



50. German light tank LKII (1918).

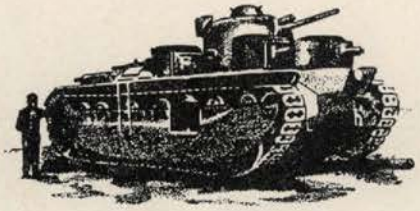
51. British Vickers-Armstrong Mark I (1922).



52. British Martel tankette (1925).

53. British Carden-Loyd tankette (1929).

54. British Vickers-Carden-Loyd reconnaissance tank (1930).



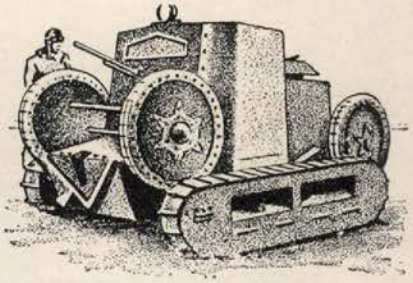
55. British heavy tank; weight: 34 tons (1925).

56. British medium Vickers tank; weight: 16 tons (1929).

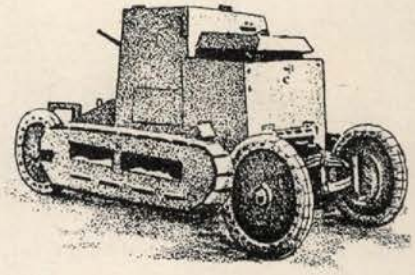
57. British light Vickers tank; weight: 6 tons (1930).

58. British cruiser tank A13 (1938).

59. French medium Delaunay-Belleville tank (1920).

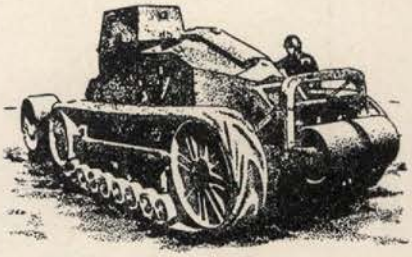


60. St. Chamond wheel-track tank on track drive (1921).



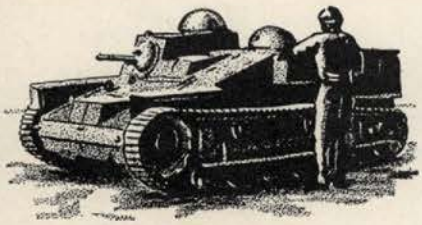
61. St. Chamond wheel-track tank on wheel drive (1921).

62. French heavy tank, 2C (1923).

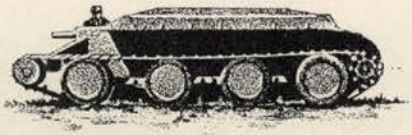


63. French light Renault tank with rubber tracks (1924).

64. French heavy tank, 3C; weight: 74 tons (1926).



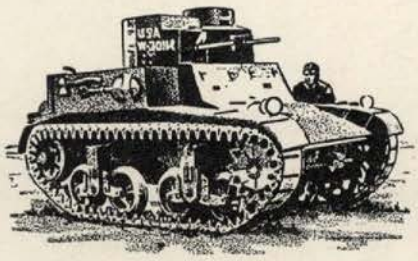
65. French Renault tankette (1933).



70. U. S. superfast Christie tank (1932).

75. German medium TIV tank (1939).

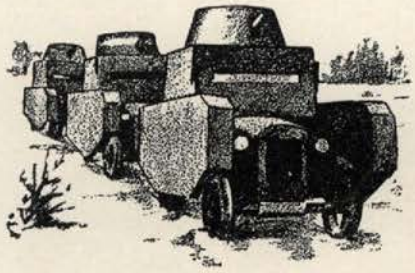
66. French light R35 tank (1935).



71. U. S. light tank T5 (1936).

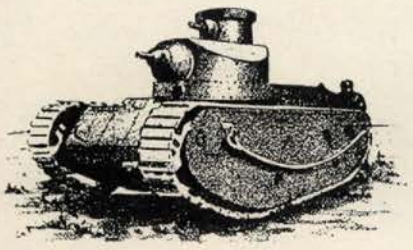
76. German heavy Rheinmetall tank (1939).

67. U. S. Christie tank (1919).



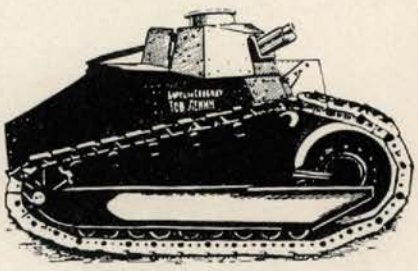
72. German dummy tanks—wooden covered trucks used to train armored forces under terms of the Versailles Treaty.

77. German 75mm self-propelled assault gun on TIII tank (1939).



68. U. S. medium tank; weight: 23 tons (1926).

73. German light tank T1. First tank constructed after Germany's violation of the Versailles Treaty (1935).

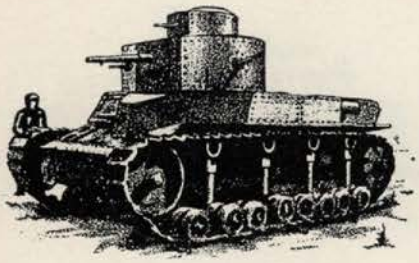


78. The first Soviet Russian tank, a Russian Renault (1920).

69. U. S. light tank T1E2 (1927).

74. German medium tank TIII, the basic mass produced tank of the first part of WWII (1939).

79. Soviet MSI small escort tank (1927).

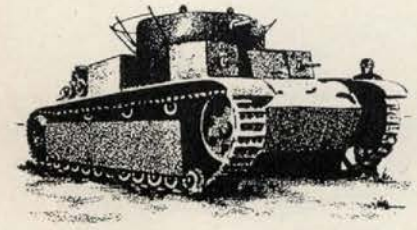


80. Soviet T24 tank (1930).

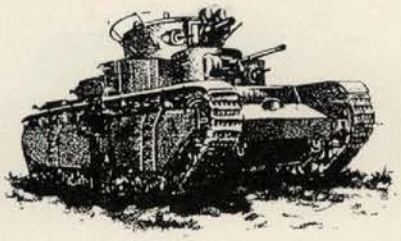
81. Soviet two man tankette T27 (1932).

82. Soviet light, three man tank, the T26 (1932).

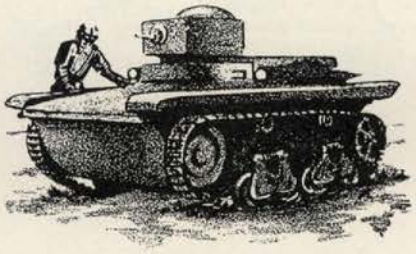
83. Soviet high speed, wheeled-tracked tank BT (1932).



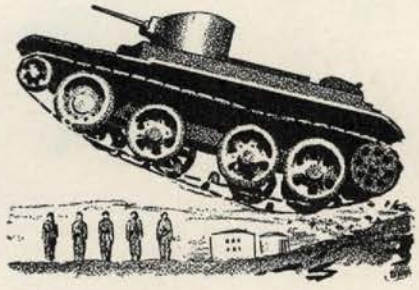
84. Soviet three-turreted medium tank, T28; six man crew (1933).



85. Soviet five-turreted heavy T35 tank; nine man crew (1933).



86. Soviet amphibious T37 tank; two man crew; weight: 3.5 tons (1932).



87. Soviet BT tank (1936).

88. Soviet amphibious T38 tank, two man crew; weight: 3.3 tons (1935).

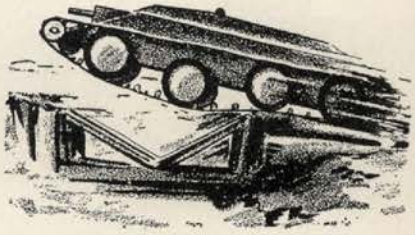
89. Soviet amphibious T40 tank; two man crew; weight: 5.8 tons (1940).

90. Soviet light T60 tank (1941).

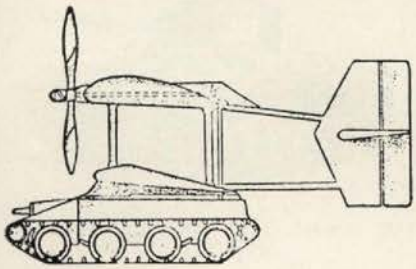
91. Soviet light T70 tank; two man crew; weight: 10 tons (1942).

92. Soviet medium T34 tank (1940).

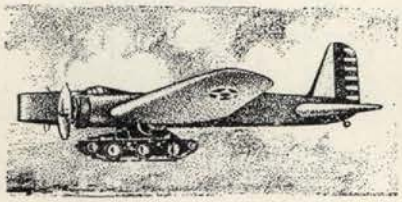
93. Soviet heavy KV tank, forerunner of the JS3 series and a tank which failed to demonstrate battleground promise early in WWII (1940).



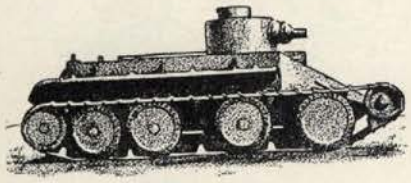
94. U. S. Christie tank (1932).



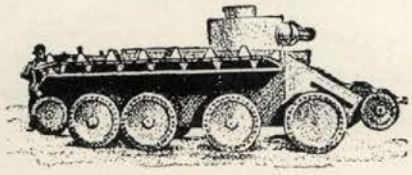
95. Flying tank, a concept of Christie (1932).



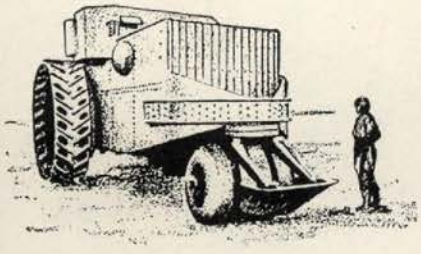
96. Christie proposal of a light tank suspended from aircraft (1933-35).



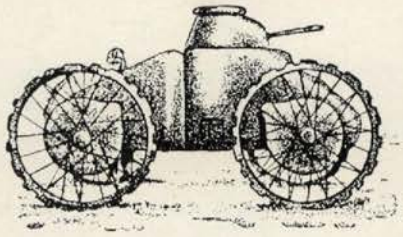
97. Christie wheel-track tank on track drive.



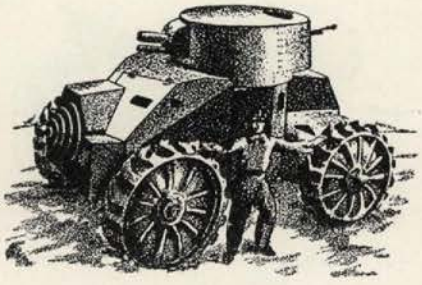
98. Christie wheel-track tank on wheel drive.



99. U. S. Holt wheeled tank with steam engine (1918).

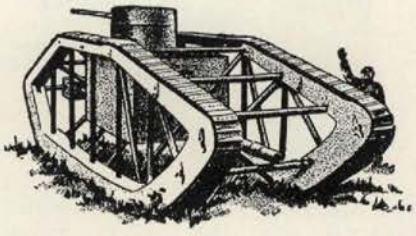


100. Italian wheeled tank (Pavezia) (1918).

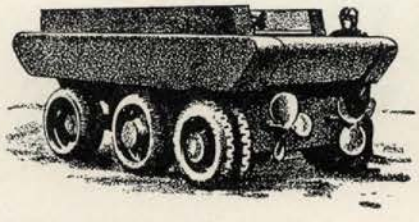


101. Italian wheeled tank (Ansaldo) (1918).

102. Italian cross country prime mover with swivel chassis (Pavezia) (1930).

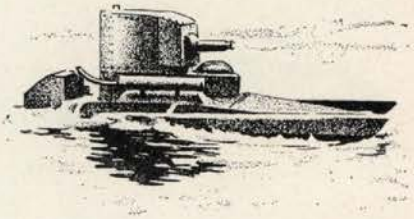


103. Skeleton tank—this concept was constructed in the U. S. (1918).



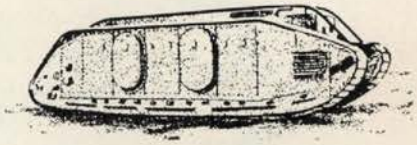
104. Christie amphibious tank; weight: 6.5 tons (1921).

105. Vickers amphibious tank; weight: 3 tons (1931).

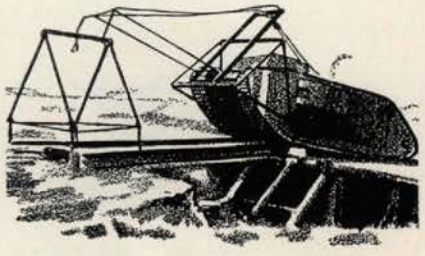


106. Vickers amphibious tankette.

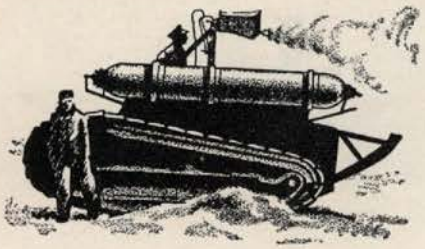
107. U. S. amphibious tank (1944).



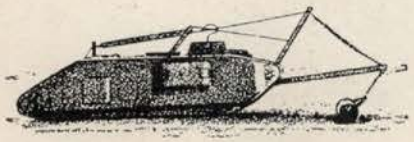
108. The tank-transport, actually the first armored personnel carrier for infantry (1918).



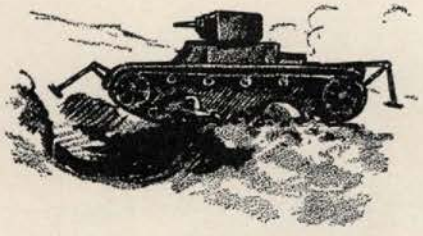
109. Bridging tank (1918).

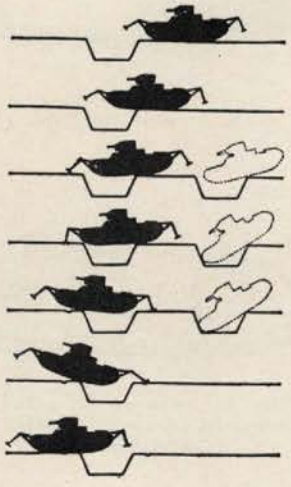


110. Chemical-warfare tank, post WWI.



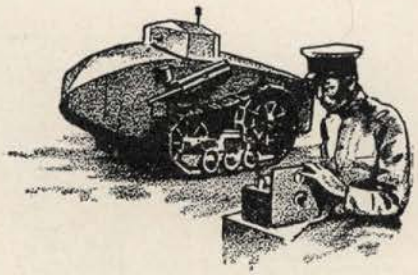
111. Mine-sweeping tank (1918).





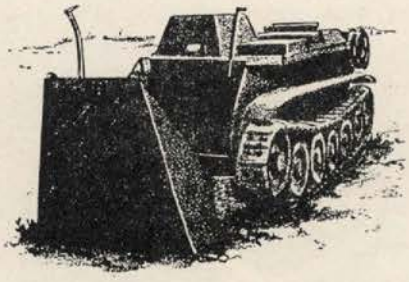
112. British Spider leg tank concept for a trench jumping tank.

113. French light tank with trench crossing tail.



114. Japanese remote radio controlled tank (1934).

115. German V4 remote controlled tank (1944).



116. German V4 remote controlled tank with demolition (450 kg) dumping blade.

117. German self-propelled track laying torpedo (1943).

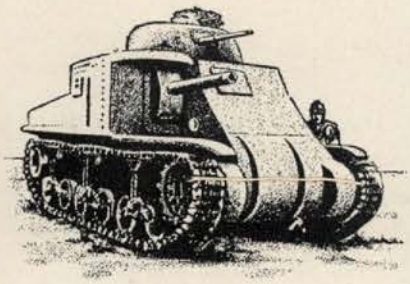
118. British light tank, the Valentine MIII (1940).

119. British medium tank, the Matilda MII (1939).

120. British heavy tank, the Churchill MIV (1942).

121. British medium tank, the Cromwell (1944).

122. U. S. M3 light tank (1940).



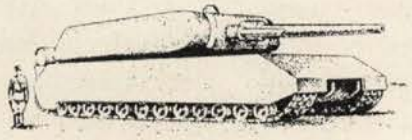
123. U. S. M3 medium tank (1940).

124. U. S. M4A2 medium Sherman tank (1941).

125. German panther tank (1943).

126. German tiger tank (1943).

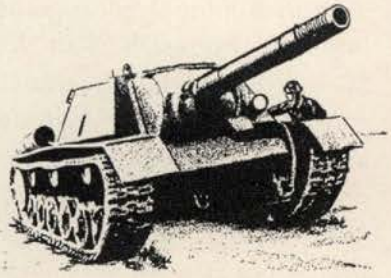
127. German royal tiger tank (1944).



128. German super-heavy tank with one 128mm and one 75mm gun (1944).

129. Soviet self-propelled gun, SU76 (1944).

130. Soviet self-propelled gun, SU122 (1944).



131. Soviet self-propelled gun, SU152 (1944).

132. Soviet Joseph Stalin tank (1945).

LIEUTENANT COLONEL ROBERT B. RIGG, Armor is well known to the readers of *ARMOR*. In addition to his many contributions to professional magazines he is the author of the books *Red China's Fighting Hordes, Realistic Combat Training* and *War, 1974*. During World War II he served as a military observer with five different allied armies, including the Soviets. Next he observed the Civil War in China for more than two years. Returning Stateside he held a Department of the Army Intelligence assignment. Subsequently he served in the Constabulary in Germany. Returning to the States he again served on the Army General Staff. He recently completed a tour with the Combat Developments Group at the U. S. Army Armor School. He is now attending the Army War College. The artwork for this pictorial history was taken from the book entitled *Tank* published in 1947 by the Military Publishing House, Moscow.

While traveling around the country during the summer months visiting armor units in field training and touching base at other armor installations, we did manage to stay in the vicinity of our national headquarters long enough to attend the three-day meeting of the Association of the United States Army. This fifth annual get-together was held during early August here in Washington, D. C. Well-attended by industrial leaders, senior commanders of the Army and members of other branches of the government, it was undoubtedly the best gathering this Association has presented. The theme for this year's meeting, *What is a Modern Army?* set the stage for similar thought-provoking subjects by all speakers, panel discussion groups and the 12 resolutions adopted during the business meeting. This theme permeated the excellent exhibits which were displayed by Industry and the Army. Several of these items, which were shown for the first time, are pictured on the following two pages (see also News Notes pages 68-69).

The Chief of Staff, General L. L. Lemnitzer, gave the keynote address, appropriately entitled, *Why We Need a Modern Army.* General Bruce C. Clarke, Commanding General, USCONARC, presented his thoughts with a talk on, *One Modern Army.* The first panel discussion on, *How We Man a Modern Army,* was headed up by the Director of Selective Service, Lieutenant General Lewis B. Hershey.

The second day's activities commenced with an excellent panel moderated by Lieutenant General Arthur G. Trudeau, Chief, Research and Development, Department of the Army. In consonance with the original theme, the title was, *Modern Army Readiness Through Research.* At the noon luncheon the AUSA was honored to be addressed by the Honorable John J. Sparkman, Senator from Alabama, on *Ground Power and Diplomacy.* The Vice Chief of Staff, General George H. Decker, was the chairman for the afternoon panel. The subject was, *How We Use a Modern Army.* The Honorable Courtney Johnson, Assistant Secretary of the Army for Logistics, chairmaned the panel discussion group on the subject of, *How We Support a Modern Army.* A special television program, presented by the U. S. Army Ordnance Guided Missile School, entitled *Modern Weapons for a Modern Army,* brought us up to the business meeting which was held the last afternoon. A total of 12 resolutions were adopted at this meeting. In the preamble, which had been drawn up by a hard-working resolutions committee, headed up by Brigadier General William J. Sutton, USAR, it stated the belief that a "strong modern army is the key to national defense" and the "security of the nation is dependent upon the recognition of a fundamental principle that wars are fought for control of land areas and the people who inhabit them." Also, the "combat soldier on the battlefield is a decisive factor to our survival; accordingly he must have the most modern equipment that our great Army-Industry team can produce." The Association pledged its support to all efforts to strengthen the ability of the U. S. Army to speak with a unified voice on vital issues. Following the adoption of the preamble, the resolutions were presented and passed. These resolutions include:

- Advocating an active army of not less than 1,000,000; a paid drill strength of not less than 300,000 in the U. S. Army Reserve and 400,000 in the Army National Guard.
- Providing the United States Army with modernized weapons and equipment at a rate and to an extent which will assure the United States a fighting force, properly armed and equipped for any type of modern warfare.
- Recommending the Secretary of Defense remove the present range limitations on the Army's use of ballistic systems.
- Recommending the Army be authorized to proceed with all possible speed in the Nike-Zeus program which is so critical to this country's security.
- Providing adequate airlift to permit movement of at least one-half of STRAC including its full logistical support.
- Lifting of weight and range limitations on Army aircraft.
- Expanding and strengthening of the High School and College ROTC program.
- Adjusting of retired pay.
- Removing the dual compensation law as it applies to retired personnel.
- Recommending that Independence Hall, Philadelphia, Pennsylvania be properly memorialized as the birthplace of the United States Army.
- Authorizing the establishment of AUSA regional organization along Army area boundaries.
- Extending a sincere vote of appreciation to certain groups in their efforts on behalf of the advancement of the Association.

If most of these resolutions are pursued by members of the AUSA, the Active Army, and the Reserve Components, many of the ills present in today's structure can be cured. On behalf of the United States Armor Association, we support these resolutions. As in the past, it is a pleasure to render such support.

The Secretary of the Army, the Honorable Wilber M. Brucker, gave the concluding address at the annual banquet. His theme, *This is a Modern Army,* emphasized that we are already striving for this modern army in many fields. But we still have a long way to go. The AUSA can do much to enhance the Army and the *individual soldier* who is the real key to the problem.

It is highly recommended that everybody obtain a copy of the September issue of *ARMY* which will carry the complete report of the meeting. In addition, the many inspiring speeches and professional panel discussions will be published. Here many new ideas can be extracted which might assist the reader to better understand this complex, yet human machine, the United States Army.

With more than 3,000 members in attendance, this year's gathering sets an all-time record and is a tribute to the planning staff and others responsible for this notable occasion. Professionally and socially, this fifth annual meeting reached an unprecedented high.

The Editor

New Equipment:

Displayed

at the AUSA meeting

SOLDIER OF THE FUTURE

With the development of tactical nuclear weapons, their use or the possibility of their use on any future battlefield has already conditioned the battlefield of tomorrow. To meet the threat of a nuclear ground war, the Army's Combat Development Experimentation Center (CDEC), located at Ford Ord, California, is working toward the development of a future Army, capable of assuring victory on this battlefield.

In developing the tactics, techniques, organizations and associated equipment requirements for the Army of the Future, CDEC has produced a soldier which is representative of the Soldier of Tomorrow which was displayed publicly for the first time at the annual meeting of the AUSA.

This individual, capable of fighting independently or in small groups, over a wide front and in sustained operations, is a graphic portrayal of America's ultimate weapon —the man. This Soldier of Tomorrow will traverse the nuclear battlefield on a zero ground pressure vehicle, either on an individual "flying platform" or as a member of a crew on a "flying car." When he leaves his vehicle, his individual "jump belt" will assist him in accomplishing his mission with minimum difficulty from small terrain obstacles such as streams, cliffs, etc. The jump belt which he himself controls will give him the ability to propel himself through the combat area at will.

As part of his personal uniform, he will wear a lightweight fully transistorized helmet radio receiver by which he will keep in touch with other elements of his unit. Since he must operate as effectively at night as he does during the day, he will wear infra-red binoculars which, in conjunction with infra-red headlights, or searchlights on his vehicle, will facilitate his negotiating the battlefield area.

To protect himself against the enemy's infra-red detecting devices, he will carry an image metascope which, due to its size and weight, will be worn much like today's soldiers wear their binoculars.

To afford tomorrow's soldier maximum physical protection, he is equipped with a face mask to guard against the thermal effects of a nuclear attack, as well as hand coverings such as his gloves of molded plastic. His protection from flying objects, shrapnel and small arms is provided by a layered nylon vest and layered nylon groin armor. Further protection is provided by explosive foxhole diggers, which he carries slung across his back. In the event of impending nuclear attack, and provided he is warned in advance, he need only to implace his explosive foxhole digger, ignite the fuse and wait for the blast. The resultant hole in the ground will give him below-ground-level protection. Completing his personal uniform are lightweight "welded" combat boots which will protect his feet from seepage of radioactive dust, water, etc.

The individual weapon that the Soldier of the Future carries is the M14 rifle chambered for the 7.62mm round. It is believed, however, that today's technology which is being applied by military-scientific teams will eventually produce for the Soldier a weapon extremely light in weight and of high velocity. This weapon, in conjunction with other types now under development, will make it unnecessary for the Soldier of Tomorrow to clash with the enemy in hand-to-hand and bayonet-to-bayonet type combat.

CDEC does not advocate that the Soldier of Tomorrow shown here is the absolute or positive fighting man of the future. He is, however, accurately representative of the fighting man in the 1965 era. As research and development continues, and as an active modernization program progresses, changes are bound to take place to increase this man's fighting potential and provide a better than reasonable degree of assurance that the U. S. Army will be prepared to meet and beat any aggressor, at any time, at any place in the world, on any nuclear battlefield.

REDEYE GUIDED MISSILE SYSTEM

The U. S. Army and Marine Corps have announced plans for joint development of a new surface-to-air shoulder-fired guided missile system called Redeye.

The Army Rocket and Guided Missile Agency, U. S. Army Ordnance Missile Command, Huntsville, Alabama, has awarded a contract, totaling approximately $6,000,000, to the Convair Division of General Dynamics Corporation for development of the system.

Redeye is a man-transportable, shoulder-fired missile system designed to destroy low-flying jets or conventional planes. The weapons system is approximately four feet long, about three inches in diameter and weighs approximately 20 pounds. It is effective at altitudes and ranges commensurate with defense of field army positions and Marine Corps amphibious operations against strafing and bombing aircraft.

The missile itself is a composite structure containing propellant, high explosive warhead and electronic guidance system. Both the missile and its launcher can easily be carried by one man through underbrush and rugged terrain where no other type of antiaircraft weapon could be transported.

TACTICAL AIR DEFENSE SYSTEM AN/MSQ18

A "vest pocket" tactical air defense system which promises nearly instant destruction of hostile airplanes by coordinating antiaircraft firing at split-second speeds, was demonstrated at the AUSA annual meeting. The system is now being deployed overseas by the U. S. Army.

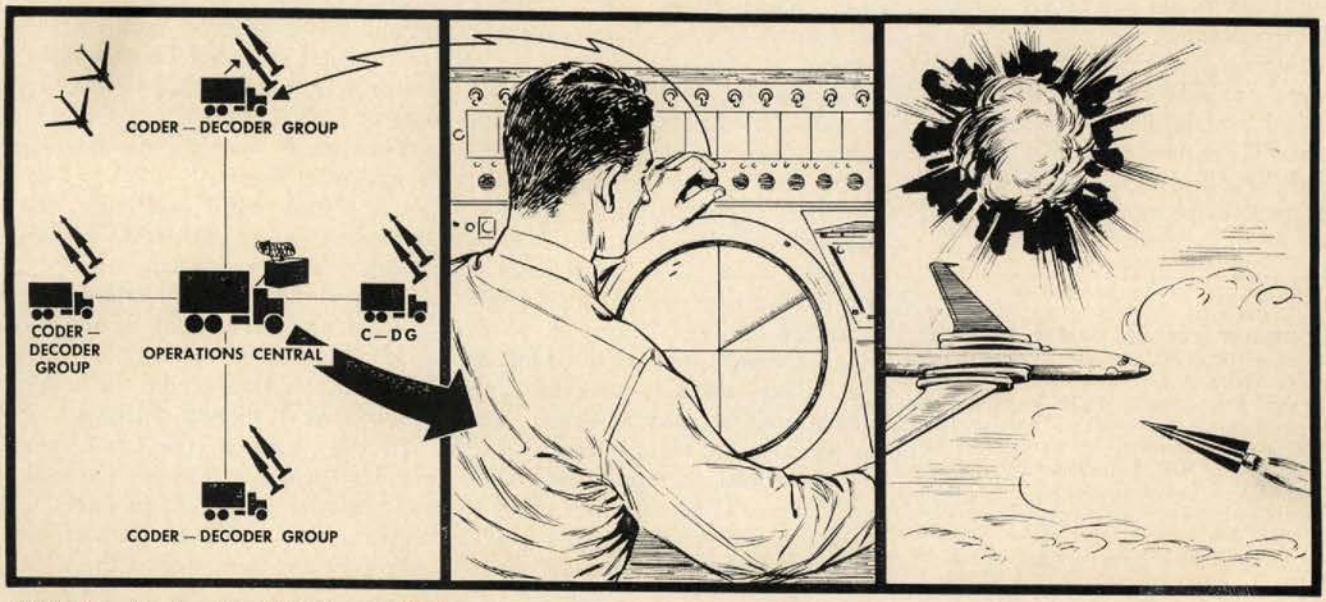
The "vest pocket" air defense system developed for the U. S. Army Signal Corps by the Hughes Aircraft Company in its Fullerton, California, plant is designed to assure almost instant destruction of hostile aircraft attempting to enter a field army's zone of defense. The system gives the air defense commander immediate control over antiaircraft missile batteries even though they might be dispersed over a very wide area.

Three principal advantages were cited for this system: *Speed:* Complex electronic data messages travel between elements of the system in milliseconds, assuring "up-to-date" pinpoint positioning of hostile aircraft. Conventional systems require many humans relaying target position by telephone, which consumes precious, critical time, and introduces the element of error.

Mobility: The ruggedly built, highly miniaturized electronic system is mounted in standard, heavy-duty 2½ ton Army trucks, and is capable of being deployed under combat conditions wherever these vehicles can be driven. Work is now under way to provide one version of this system mounted in "helihuts" for movement by helicopter.

Reliability: Transmission of electronic data between elements of the AN/MSQ18 "vest pocket" air defense system by digital process greatly reduces the possibility of error. The use of the digital data transmission technique reduces the size and complexity of system components, thus reducing the number of possible failures within a given task.

The "vest pocket" air defense system consists of a truck-mounted operations central, from which an Army Battalion commander may observe the air battle, and several battery equipments called coder-decoder units. These units are located at Hawk or Nike missile batteries and provide the batteries with electronic data on hostile aircraft entering the field army's zone of defense. The coder-decoder units convert electronic data from digital to analog form for use by currently operational missiles.



By LIEUTENANT COLONEL ALBERT E. SEIFERT

FIGHTING HELICOPTERS?—YES

EVER since the first tanks lumbered across the battlefield of the Somme, critics of Armor have declared that the tank is dead. Like the premature reports of Mark Twain's death, these announcements have been greatly exaggerated. Indeed, Armor with its armor-protected firepower, mobility and shock action, is most capable of survival on the modern battlefield. However, progress must continue to be made to enhance these characteristics.

A step in the right direction has been taken by integrating Army Aviation more extensively into the Armored Division. The U. S. Army Aviation and The U. S. Army Armor Schools have demonstrated that "suppressive fire" can be delivered by helicopter-mounted rockets and machine guns. This, of course, is merely an experimental beginning, but it opens up some very interesting possibilities.

Suppose, for example, the helicopter could be armored and suppose it had a more efficient weapons system. There are plastics which are both light and tough and could well be used to provide light armor protection. Technicians can easily determine how much and where this plastic armor should be mounted. For firepower, the Army Ballistic Missile Agency at Redstone Arsenal could develop a weapons system tailor-made to fit helicopters. Some of the characteristics desired in the system are:

1. Ability to aim and fire automatic weapons without regard to flying attitude.
2. Ability to reduce jams and misfires while in flight.
3. Ability to reload in flight.
4. A weapon and guidance system which will give the helicopter a "hard target" capability.

An organization equipped with helicopters having plastic armor and this weapons system would possess light armor-protected firepower, mobility coupled with agility, and certainly shock action—all of which embody the primary fighting characteristics of Armor.

For the sake of this discussion, let us consider the composition of an armored helicopter company organization and its possible employment. The current armored rifle squad is suitable as the basic unit of this company but instead of the M59 armored personnel carrier, the squad is transported in an H34 helicopter. With nine helicopters we have three squads each. Two additional machine gun squads and the current 81mm mortar platooon are transported in three more helicopters as a composite Weapons Platoon. This constitutes a potent combat company. Two H37's would provide ample lift capability as a Support Platoon for resupply of ammunition, spare parts, rations, etc. The company commander can be mounted in an H13, and the rest of the command element distributed among the H34's.

What are the basic techniques of employing this company? Virtually the same as employing a tank company—establish a base of fire and maneuver to one or both flanks. But how much more significance the term *fire and maneuver* assumes! Maneuver means the movement to place troops or fire in a more advantageous position with respect to the enemy. With the armored helicopter both can be accomplished at speeds impossible on the ground. Troops can be selectively landed in relatively undefended areas and aircraft employed in a direct fire support role for the ground assault. Once the objective is taken, a link-up must be made by armor ground elements. The endurance of this isolated unit can be prolonged, however, through resupply by its organic helicopters.

Visualize, if you will, the situation as shown in *Figure 1*. CCA is composed of two tank battalions, one armored infantry battalion, an armored helicopter company and normal supporting troops. The area just in front of Hills A and B, and for some distance to either flank, is heavily mined. CCA must seize the bridge at Objective 1 without delay.

In this situation, the CCA commander decides to commit the tank and armored infantry task forces to support by fire the movement of his helicopter company around the right

LIEUTENANT COLONEL ALBERT E. SEIFERT, Armor, a 1942 USMA graduate, served in Europe during World War II with the 14th Armored Division. After attending C&GSC he returned to Germany to the Constabulary. Returning Stateside he was an Advisor with the Colorado National Guard. Next he attended the Advance Class at Knox and was assigned to the 2d Armored Division. Returning to Europe he served in USAREUR Headquarters. After a short Stateside tour at Fort Myer he went to MAAG, Japan. He is now a Tactics Instructor at the USAARMS.

flank as shown in *Figure 1*. The helicopter company commander designates one platoon to cover the company's advance by firing on known and suspected enemy positions until the last helicopter has passed, at which time the platoon will follow the company in to the landing zone. Upon landing, the helicopter assault force proceeds as in any other normal operation, with this exception: In addition to the normal fire support of its organic mortar and machine gun squads it has the direct fire support of nine fighting helicopters with a punch. The remainder of CCA proceeds to breach the minefields in the conventional manner and to link up with the helicopter company.

Although this situation is oversimplified, it illustrates schematically the terrific flexibility afforded the armor commmander who has such an aerial assault force at his disposal.

In ROCAD there are six light cargo and eight utility helicopters for the entire division. These are far too few to give the lift required to support three combat commands, and furthermore, these craft are neither organized nor equipped to fight. It is apparent that the addition of one helicopter battalion (consisting of three line companies and a headquarters and service company) would give the armored division the necessary independence of terrain that is required on the modern battlefield. Obviously this battalion would contribute immensely to the division's vaunted speed and mobility. In this regard, even though non-divisional units could provide the helicopters, it is as important to place these companies within the division as it is to have organic reconnaissance squadrons.

Missions assigned the helicopter unit are not limited to envelopments. The firepower delivered by these aerial gun platforms could be maneuvered at will to assist the advance of land units. Limited objectives could be seized for the same purpose, where such a situation required it. Possible secondary missions are numerous and varied. The helicopters can be used in surveillance, patrols, resupply, evacuation, etc., while the troops can be employed in a ground role at any time they are needed.

To the skeptics who point out the vulnerability of the helicopter, the same views were expressed about the old liaison planes when they were first used in World War II. The armored helicopter would be neither helpless nor defenseless. To be hit, the helicopter must be seen. Skillful pilots, like good tankers, take advantage of terrain in order to reach the objective without being exposed except for brief periods of time. This will be normal procedure on the battlefield where units are widely dispersed. Even when exposed, pilots will fly so fast that the helicopters present no more than a fleeting target. As for the noise, considerable confusion can be created by using sound equipment, high performance aircraft, tanks, artillery and diversionary helicopters in an attack.

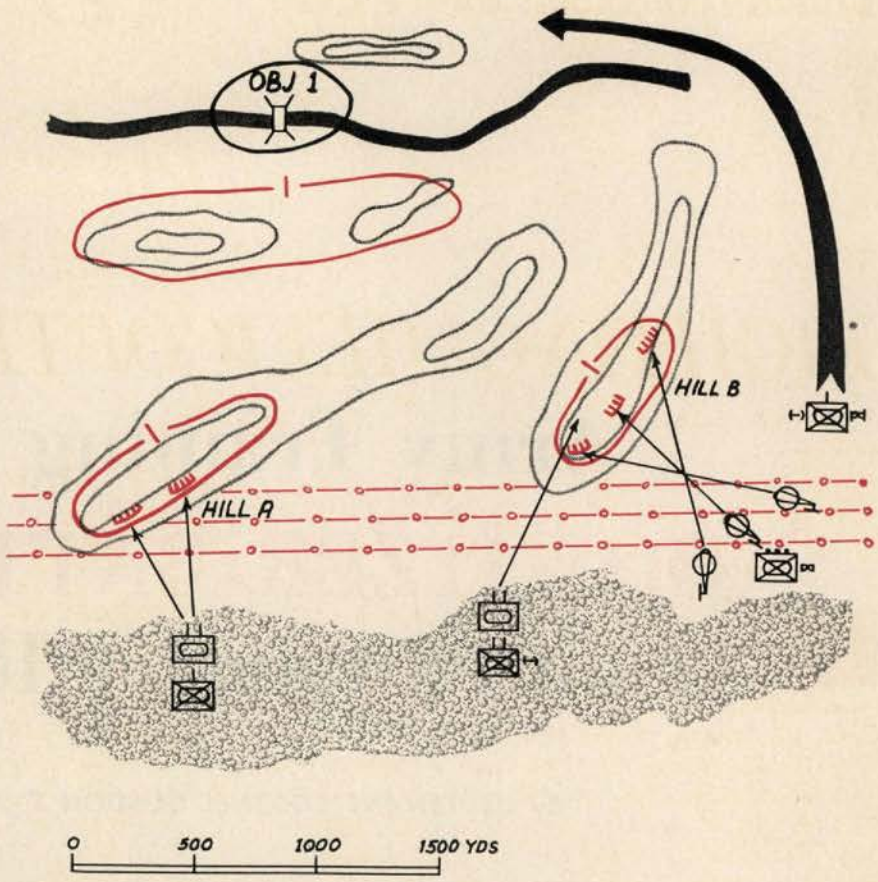


Figure 1.

Some opponents of the idea that Armor should ever leave the ground point out that helicopters do not have an all-weather capability and cannot operate after dark. Tests are now being conducted to provide this capability. It is worth noting, also, that heavy snow, sleet and fog will depreciate the capabilities of terrain-bound units as well. As for non-illuminated night flying, that will depend primarily upon the state of pilot training and the use of pathfinder equipment. Incidentally, a new plastic has recently been developed which, when installed in helicopter windshields, permits far better night vision than has heretofore been possible.

Perhaps it would be well at this point to state that while helicopters are referred to as being the primary vehicle they are not necessarily the ultimate. Certainly, research and development agencies can and will improve on this form of aerial platform. However, the helicopter is now in being and *can* be utilized today!

In brief, Armor has traditionally been progressive in its thinking. We must plan now to increase the mobility of the Armored Division in the future. The vanguard of future offensives will consist of units capable of directing its combat power swiftly at decisive points and of consolidating its gains by emplacing troops on the ground. The addition of armored helicopters would give added meaning to "Armor—the Combat Arm of Decision."

Army Training Test- HOWITZER BATTERIES, Armored Cavalry Regiment

By LIEUTENANT COLONEL GORDON E. McQUAIN

THE organization and operation of the United States Army's Armored Cavalry Regiment approaches the ultimate required for success in a nuclear or non-nuclear war. It is capable of operating over wide areas; possesses rapid mobility, light to medium armor protection, some radiation protection, heavy firepower and excellent means of communication.

The armored cavalry is organized into integrated teams of combined arms, starting at the platoon level, designed to operate independently on mission type orders. The recent addition of the army aviation company increases its capabilities. This company gives added flexibility and control to this rapid moving force.

On the modern battlefield where control and lack of compactness are the keynotes the commander must maneuver his combat units swiftly for effective application of combat power and then disperse rapidly upon achieving his objective. The means to accomplish this are presently available in the organization of the armored cavalry.

In the midst of missile and nuclear advances, training of all elements of the Regiment to include reconnaissance companies, tank companies and howitzer batteries must provide for either nuclear or non-nuclear war. Although the Department of the Army and the Continental Army Command prescribe certain minimum standards and training objectives that a unit is to achieve in a given period of time, the unit commander is responsible for training his unit to perform assigned missions. Emphasis in training must be given to increasing the speed and versatility of movement and range and weight of firepower. Although Army Training Tests (ATT) insure that standards for training are uniform throughout the Army for similar type units, these tests must be administered to evaluate the unit's ability to perform the mission for which it is organized. In analyzing the capabilities of the organic artillery support of the Armored Cavalry, it is readily apparent that the inherent speed and cross-country mobility of these type units allow for rapid dispersion, concentration for the assault and redispersion to avoid presenting a lucrative target. These capabilities are required to fight either a nuclear or non-nuclear war and a test of these capabilities should be made during the unit's training cycle.

A test that would accomplish this goal is outlined below:

Phase I

First Requirement: On D-Day each vehicle crew will display all on-vehicle material (OVM). Nearby the battery personnel will display a full field layout of clothing and equipment. Meanwhile, selected vehicles

LIEUTENANT COLONEL GORDON E. McQUAIN, Armor, served in the Pacific during World War II with the 762d Tank Battalion. Subsequently he was an instructor at Fort Knox. After attending the Advance Class he went to Germany where he became S3 of the 2d ACR. Returning to the States he was Advisor with the Army Reserve in Colorado. Next he was a member of the MAAG in Taiwan. He returned to Knox and commanded a Battalion in the 6th ACR. He is presently in the G1 Section, U. S. Army Armor Center, Fort Knox.

In analyzing the capabilities of the organic artillery support of the Armored Cavalry, it is readily apparent that the inherent speed and cross-country mobility of these type units allow for rapid dispersion, concentration for the assault and redispersion to avoid presenting a lucrative target. These capabilities are required to fight either a nuclear or non-nuclear war and a test of these capabilities should be made during the unit's cycle.

will receive a technical inspection (TI) from the Battalion Maintenance Section.

Second Requirement: The tested battery will complete a military stakes course designed to test each individual on such subjects as: CBR, communications, first echelon maintenance, map reading, artillery adjustment, assembly and disassembly of the LMG Cal 30.

Third Requirement: Each member of the tested battery will be required to complete the Physical Training Test as outlined in FM 21-20.

Fourth Requirement: On D+1 all members of the tested battery will report with all vehicles and equipment to designated ranges. There they will fire a modified record course for individual weapons and all crew-served weapons except the howitzers. As each range is completed the vehicles and crews will report to an assembly area.

Phase II

Fifth Requirement: The battery will move into the assembly area, occupy firing positions and stand by. It will organize the area in consonance with the battery plan, refuel, perform necessary maintenance and feed the noon meal.

Sixth Requirement: The battery commander will receive the battalion order to move to a pre-selected area. Here the battery will conduct a road march, fire an impact and time registration, perform survey, fire a transfer, compute a non-firing transfer with met and VE, and establish night security. This requirement should be conducted by a ground observer.

Seventh Requirement: The battery will receive an order to move to another location (night displacement). Here the battery will fire at targets of opportunity under illumination. The battery will be responsible for the security of the area. Small Aggressor patrols will harass them during the night.

Eighth Requirement: On D+2 the battery receives orders to displace. While moving they will encounter a road block and receive small arms fire (infiltrators, partisans or guerrillas). The battery will clear the road block and continue moving. Prior to arrival in its new position the battery will receive a "crash" mission and fire on targets of opportunity. This requirement should be conducted by an air observer.

Ninth Requirement: The enemy situation will force the battery to displace by echelon in order to render continuous fire support to elements of the reconnaissance battalion. One section continues to fire on targets of opportunity while the rest of the battery withdraws and occupies a new firing position. When the displaced section can take over the fire mission the remaining section displaces and rejoins the battery, occupies position and prepares to fire. This requirement is conducted by an observer in a tank.

Phase III

Tenth Requirement: When the howitzer battery assembles and prepares to fire as a unit the chief umpire will terminate the tactical phase and direct the battery to move to the motor pool for final inspection. This inspection is conducted the same as in the *First Requirement*. At the completion of the inspection the test is terminated.

In grading and evaluating Phase II of the test, approximately 75 percent should be given for the operation of the fire direction center, survey, gunnery and conduct of fire. The rest of the test, tactics and communications, should constitute 25 percent. Phases I and II will be evaluated in accordance with currently approved techniques.

To administer the test properly the armored cavalry battalion S2-S3 operations section should take to the field and pass all tactical orders to the tested battery. The normal communication nets should be used for command and logistical support. The battalion commander and the S3 should give orders as would be normal in combat. Umpires are to insure safety and evaluate the test only and not enter in to the tactical operations or give the tactical situation and orders.

It matters not what the armored cavalry regiment may be called nor whether its organic units are battalions or squadrons, the inherent capabilities and the concepts of operation in modern war are still there. This battery, with the same characteristics, has the ability and flexibility to engage targets over a wide area. It must be trained, ready and able to utilize its light armor protection, cross-country mobility and rapid "in and out of action" capabilities. The inherent characteristics of the full tracked howitzer with its on-vehicle features of gun crew, ammunition and weapon enables the howitzer battery to "shoot from the hip."

By PRIVATE FIRST CLASS PAUL COUNSELL

Field Modifications:
GI Ingenuity in Action

FIELD modifications have long been an accepted means of improving equipment and training. To comply with Seventh Army training requirements in Germany, two modifications for the M48-A1 tank and one for the ¼ ton scout vehicle were developed by First Lieutenant Joseph R. Mendelson of the 2d Medium Tank Battalion, 66th Armor.

These modifications, currently in use on all 4th Armored Division tanks and scout vehicles, are described for possible use by other armored units. All of them may be fabricated by organic maintenance shops, using only scrap material.

In 1958, the 4th Armored Division experimented with mounting a .50 caliber machine gun on the barrel of the tank's main armament to train gunners on Table VII. This gun was mounted on a cradle which clamped on the 90mm tube.

The weapon often worked loose and fired wild, however, making it necessary for the loader to climb out on the tube to clear malfunctions.

Lt. Mendelson modified the .30 caliber coaxial mount so that it would mount the .50 caliber machine gun as well. The mount, after this modification, resembles the M47 tank mount.

As shown in *Figure 1*, by welding a small plate just behind the existing plate on the front of the M48 coaxial machine gun mount and drilling it to duplicate the cradle hole pattern, the .50 caliber can be mounted by merely moving the cradle back to the new holes. The rear traversing and elevation mechanism

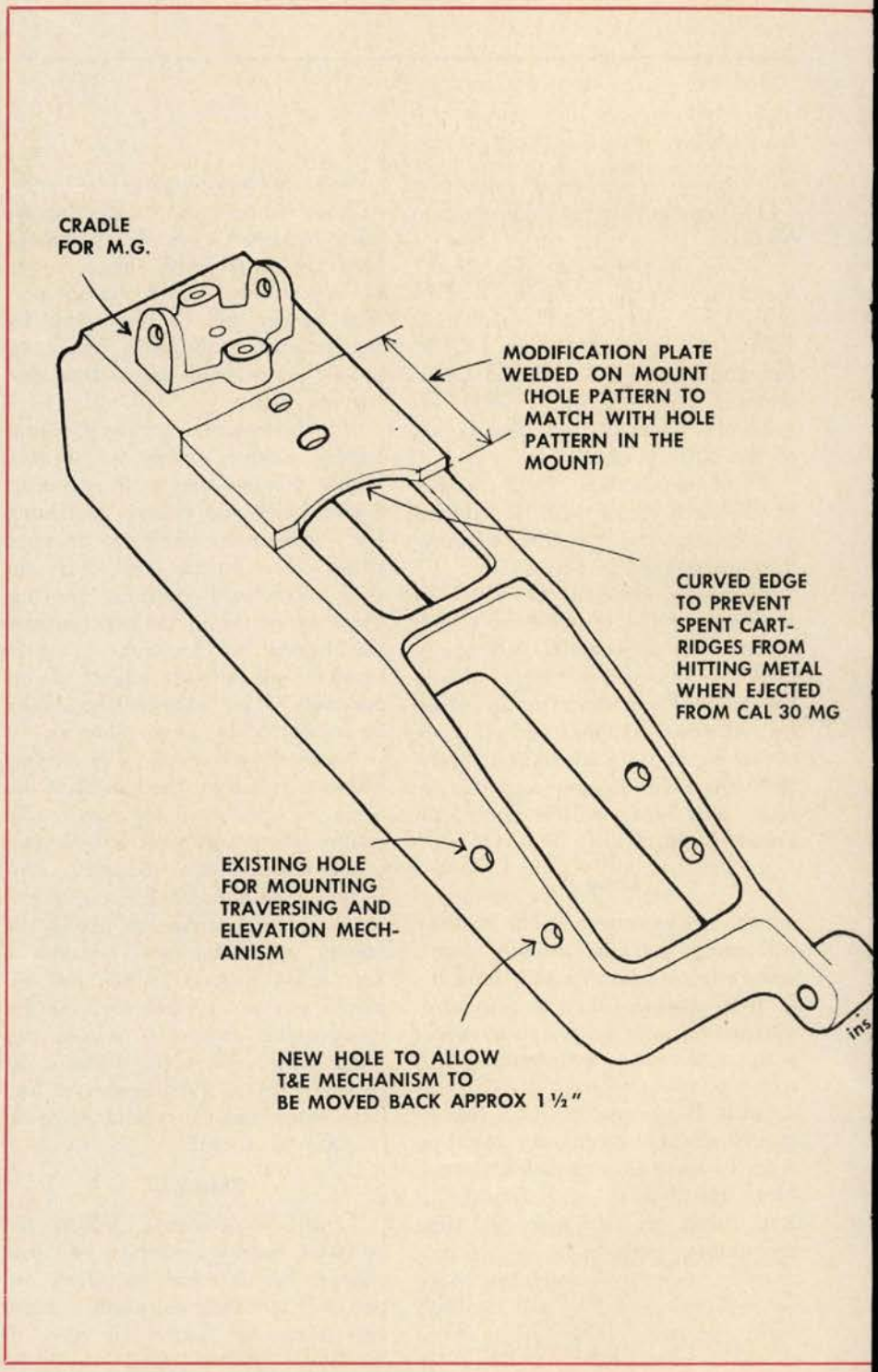


Figure 1

PRIVATE FIRST CLASS PAUL COUNSELL graduated from the University of Wisconsin where he majored in Advertising. He is a staff correspondent with the Public Information Section, 4th Armored Division, Seventh U. S. Army.

must also be moved back to a new set of holes which are drilled approximately one and one-half inches to the rear of the existing ones. This modification permits a loader to convert from .30 caliber to .50 caliber in ten minutes or less.

To utilize this development, the Tank Training Center at Vilseck, Germany, has constructed a gunnery table known as Table VII½. It is a duplication of Table VII with a smaller target at a closer range, usually about 800 to 1,000 yards. This allows unlimited practice on Table VII in the normal technique of fire but without the expense and requirements of service firing. It also allows the gunner to familiarize himself with the noise of firing, a factor which has hampered many a new tank crewman.

To provide ¼ ton scout machine gun vehicles with a training device that will increase mounted machine gun firing techniques, Lt. Mendelson has devised the traverse and elevation limiting device. *See Figure* 2. This device can be clamped on any machine gun pedestal mount in approximately three minutes and is designed for use on Old Tank Table III.

Since the device confines the fire within a safe area without limiting the target area, the gunner can lay and fire on targets in normal succession without danger of injury to the driver or damage to the front of the vehicle. It has proven to be quite successful in training the scout gunners of the division.

A factor affecting the safety and serviceability of the division's tanks was the rapid and repeated damage of the auxiliary generator mufflers which are mounted in an exposed position on the rear deck where they were often stepped on and broken.

To overcome this, Lieutenant Mendelson designed a small protective cage, *see Figure* 3, which readily bolts on the tank and protects the muffler while still allowing the removal of trash and debris which accumulate during training. This device is fabricated from ammunition crate rods and scrap angle iron. It can be mounted in about five minutes once a bracket has been welded on the tank. Since installation of these cages, muffler replacement has become negligible.

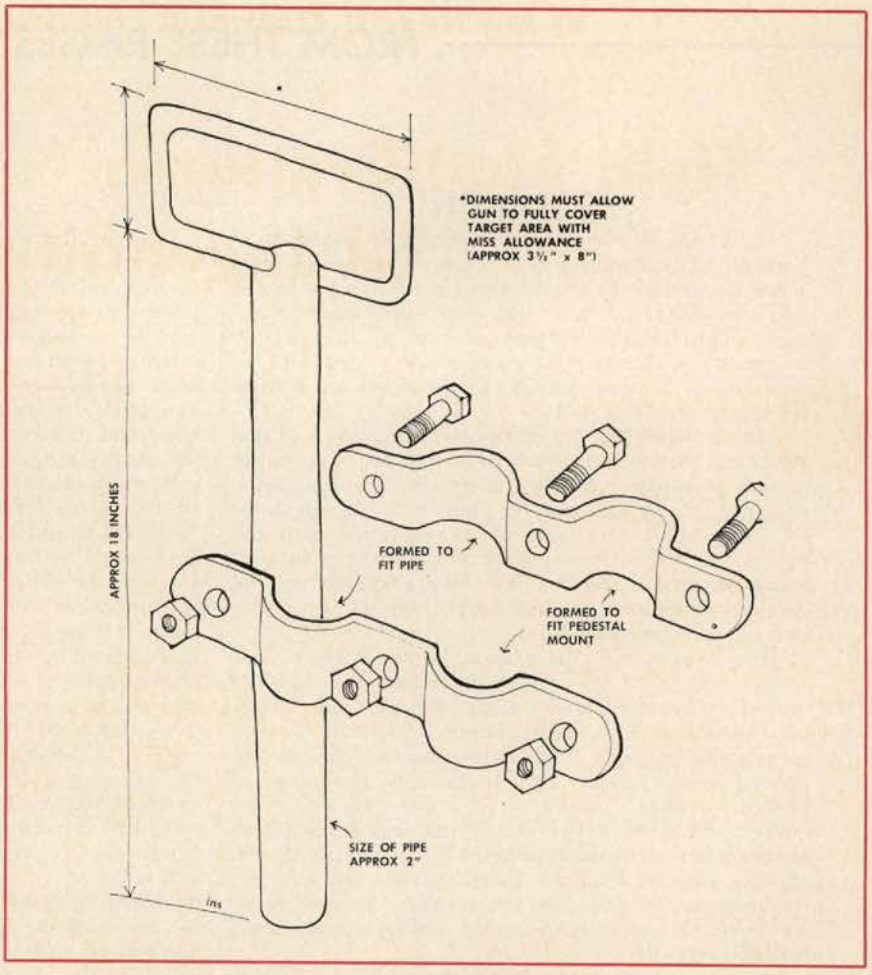


Figure 2

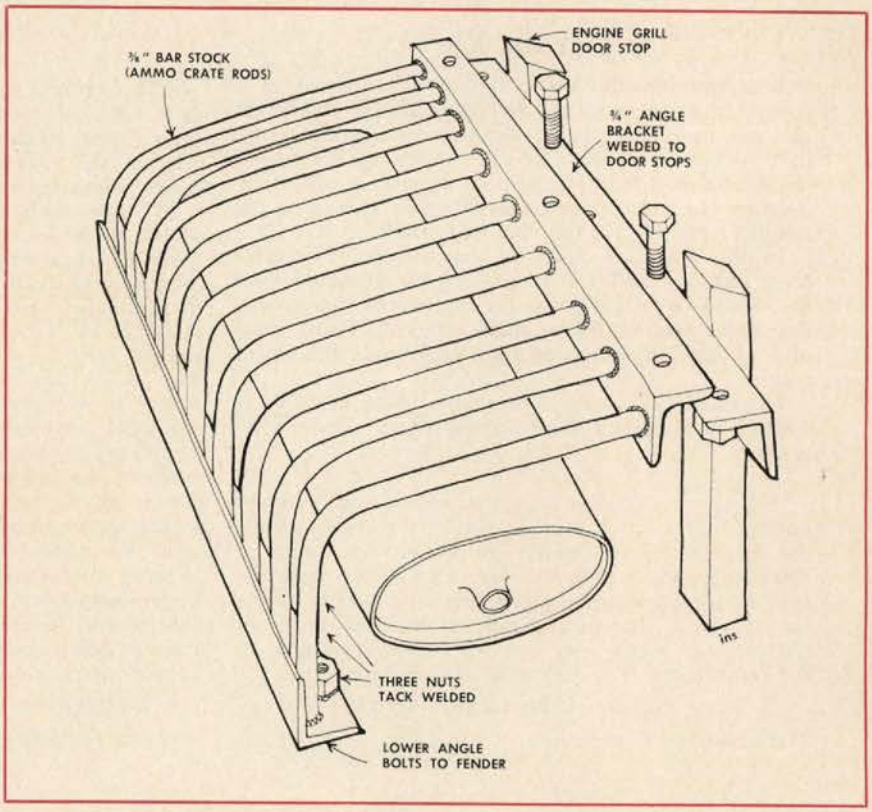


Figure 3

FROM THESE PAGES

65 Years Ago

There are, however, some situations when it is imperative to attack; for instance, when one comes across a patrol of the enemy about to make some important discovery relative to our own forces and dispositions. This should be prevented at all hazard. Or where it is necessary to capture some prisoners. It is always to be remembered that prisoners are a fruitful source of information.

After a patrol had accomplished its mission and was returning to its own lines, if it saw an opportunity to attack a patrol of the enemy and capture some prisoners, it should not be neglected. Again, if at any time one comes suddenly across a patrol of the enemy, so that it is necessary to either fight or run, it would usually be best to make a charge on the enemy and trust to the resulting confusion to enable one to make his escape.

This is especially the case at night. Boldness and audacity seem to be even more successful when indulged in by small bodies than by large ones. When two parties are mutually surprised, success usually goes to the one which takes the initiative. But in the general case, patrols, unless specially sent out to capture prisoners, should avoid similar patrols of the enemy, and endeavor by shrewdness and woodcraft to accomplish their mission secretly, for it cannot be too strongly insisted on that officers' patrols are sent out for information and not for security, except in so far as timely information of the enemy's movements furnishes security.

First Lieutenant W. H. Smith

Officers' Patrols

50 Years Ago

Speaking broadly, the best use of cavalry is in a combination of mounted and dismounted action. In this use machine guns are particularly valuable, as by their firepower they are able to supplement the fire of the dismounted men to such an extent as to materially decrease the number necessary, thereby increasing the number available for the mounted attack.

In the mounted attack of cavalry against cavalry these guns are useful in compelling, by means of their fire, an earlier deployment on the part of the enemy than otherwise would be made, thus disclosing their plan of attack and making the attack more difficult of control.

It has already been shown that their mobility is such as to permit of their accompanying cavalry anywhere.

* * *

The cavalry attack is supported by the horse artillery until within a few hundred yards of the enemy, while the machine guns, though supporting the attack at rifle ranges and helping to keep down and draw the fire of any small arms, are particularly useful in the last stages of the attack, and, in the first stages of the pursuit, where, on account of the closeness of the combatants, it is dangerous for artillery to fire.

Second Lieutenant Henry J. Reilly

Machine Gun Organization

25 Years Ago

The cavalry machine gun represents massed fire and economy of force, mobility and surprise. It makes the cavalry, suitably equipped with it, a formidable opponent to any enemy. Does the inclusion of machine guns in a cavalry force make the latter merely mounted infantry? Certainly not; mounted infantry uses the horse merely for transportation; whereas a cavalryman is a good shot mounted on a disciplined horse, both horse and rider trained for mounted combat. And if the cavalryman, in addition, be trained to approximate a good infantryman in dismounted combat, he becomes an even more formidable opponent.

When should we fight mounted? A good cavalryman would always prefer mounted action within reason, but the decision, in a particular case, should not be influenced by sentiment. A professional soldier must be a good haggler—a shrewd bargainer. We may have something that the enemy wants, but which our mission requires us to hold; if the enemy has the necessary means and insists on obtaining it, we will make it as expensive for him to secure as possible. Conversely, if the enemy has something which we want, we will buy it at as cheap a cost as possible. When mounted action means a higher price, then the decision should be for dismounted action, certainly in all cases when other factors, as time, are not vital. "Buy cheap and sell dear," should be our rule for decision, and we must be prepared to take prompt and decisive advantage of any bargain presented, whether for mounted or dismounted action.

Major Joseph L. Philips

Efficiency—Tactical or Technical?

10 Years Ago

The Germans conceived the armored breakthrough as a means of overcoming the two factors which had caused their defeat in World War I: Numerical superiority of the enemy in personnel. *Potentially* greater enemy industrial output.

In many ways the United States faces a problem similar to the one which faced Germany in September 1939; i.e. at present the U. S. has the *developed* capacity to out-produce any logical group of enemies, but these enemies have the *undeveloped* capacity to far exceed this U. S. industrial production. Also, the logical group of enemy has overwhelming personnel superiority. The U. S. must develop means of insuring a speedy victory in any possible future war before the enemy industrial potential can be developed and before their manpower advantage can wear us down in a war of attrition. The armored breakthrough is not the solution to all of these problems; but it does provide us with a means of securing a speedy success on a large scale. We must not look *backward* at World War II as being the final answer to the armored breakthrough. Better techniques and better machines must be available in the future to enable a small highly mobile army to defeat *quickly* a large, massed personnel army having inferior mobility, firepower and shock action.

Lieutenant Colonel George B. Pickett, Jr.

Armored Breakthrough

Antitank Missiles For Armored Infantry

The four contributing authors to this thought provoking article are: Lt. Col. John D. Webber, 4th Armored Division; Capt. Norman D. DeBord, XXth U. S. Army Corps; and Capts. Clifford D. Rhodes and Robert W. Thams, both attending Command and General Staff College, Fort Leavenworth, Kansas.

ARMORED infantry needs more antitank firepower! "Incredible!", some of you will no doubt exclaim. However, we hope there will be as many of our readers who will affirmatively and vigorously second the motion especially after you have finished reading the case we are about to present.

A definite need exists in the armored infantry battalions of the armored division for more antitank firepower than is now available. In presenting this claim, the standard reaction is, "but you are surrounded with firepower." What better antitank weapon is there than a 90mm tank gun? That is a good question, but a generalization which does not stand up too well to detailed examination. On the first count, of being "surrounded" by M48 tanks, a quick look and a rapid bit of arithmetic reveal that armored infantry units are not surrounded by tanks. Under standard armor cross-reinforcing tactics, typical divisional organization shows a tank-heavy combat command with two tank battalions and one armored infantry battalion. After cross reinforcing, the armored infantry battalion is a balanced task force with two infantry companies and two tank companies and the tank battalions gain one infantry company each and lose one tank company each. In this case all infantry companies would probably have one tank platoon attached, but this is the most favorable situation found in the division. Another combat command probably would be balanced with one tank battalion and one infantry battalion. Cross reinforcing between battalions and then between companies within the battalions results in two of the infantry companies without any tanks attached or in their area. The remaining combat command is then infantry heavy with one tank battalion and two infantry battalions. Standard cross reinforcing in this case yields a balanced task force in the tank battalion whose attached infantry companies would no doubt have a tank platoon each. The infantry battalions have a tank company each with two infantry companies in each battalion minus attached tanks. The sum total of this is that six out of the 16 rifle companies in the division can expect to be habitually without attached tanks. The other companies will normally have one tank platoon. This indicates a large area in which little antitank capability exists and this without challenging the use of tanks as the primary antitank means in the other 10 companies.

Even within a battle position where tanks are present, their use primarily in the antitank role is questionable. It violates armor doctrine of using tanks offensively wherever possible. This doctrine is acceptable to most of us because we know it best utilizes the armor characteristics of mobility, firepower and shock action. Of these capabilities, mobility and shock action are wasted whenever tanks are employed as antitank weapons. Also commonly accepted is the fact that, in defense, tanks are best used in positions of readiness, prepared for violent execution as a mobile striking force. It would seem that an M48 tank sitting idly in an antitank gun position is a luxury we can ill afford.

The other side of the defense coin is that while the striking force is poised in readiness, the infantry must bear the initial burden of defense at the forward edge of the battle area. To accomplish this sizable task, the armored infantry battalion, especially the company, is distinctly on the short end of the stick. They have attached tanks and the 3.5 inch rocket launcher. As we have seen, the tanks are numerically inferior and economically questionable and, regardless of its demonstrated capabilities, anybody who has ever pointed a 3.5 toward 40 or 50 tons of approaching hostile tank will firmly categorize it with the .45 caliber pistol, *i.e.*, an emergency weapon more commonly referred to as a foxhole protector.

Thus the factors combine inadequate organic weapons, questionable dependence upon attached tanks, and

(U. S. Army)

The SS10 antitank missile in its initial position after having been attached to the platform by the two loaders.

(U. S. Army)

The characteristics of the crew procedure are illustrated as the missile is rotated to its topside firing position.

the cold fact of not having enough tanks to go around. This demonstrates, to our mind, a critical need for additional antitank firepower in the divisional armored infantry battalions.

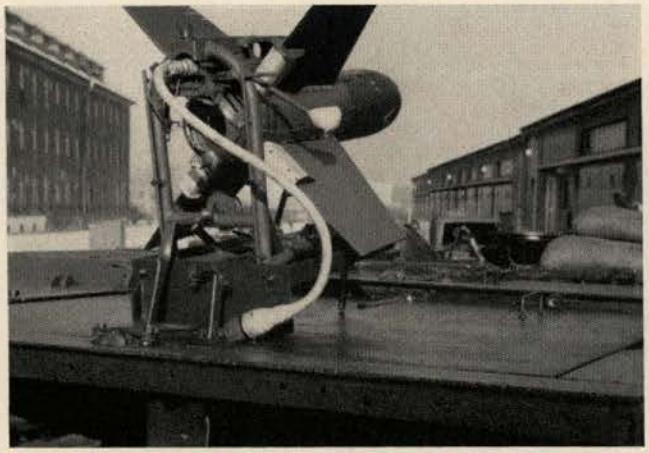
Having posed the problem we propose the solution. We should start, perhaps, with a brief look at the theoretical requirements of such a solution. *First,* a suitable weapon should have the same basic characteristics as any piece of combat equipment; simplicity, ruggedness and an acceptable maintenance level, to name just a few. *Second,* it must possess the punch to do the job—or we have no weapon at all. *Third,* it must be at least as mobile as the armored infantry who will be using it. *Fourth,* and perhaps the most important of all, it must possess the same armor protection as the armored infantry so as to meet tactical requirements in the same manner. We think the solution to this problem lies in the form of the French SS10 antitank guided missile.

The SS10 is a complete missile system, the principal component of which is a rocket propelled, guided, antitank missile weighing 33 pounds. After firing, the speeding missile pays out two fine steel wires which maintain electrical contact between the flight controls within the missile body and the guidance system at the gunner's position. The gunner maintains visual contact between himself, the rocket and the target, and, through the use of a "wobble stick" on the control box, maneuvers the rocket into the target. The missile system has a maximum range of 1750 yards. It has a minimum range of approximately 500 yards, at which distance the missile has reached high enough velocity for it to respond adequately to control commands. This, of course, is of tactical significance in its utilization. The rate of fire is restricted by the ability of the gunner and electronic system to guide only one missile at one time. Another missile can be fired immediately after the detonation of the first. The flight time to maximum range is approximately 20 seconds. Also of considerable importance is the fact that the missile comes mounted on its own launching rail; hence, no complicated preparation for firing is necessary.

The crew for the weapon varies according to the type vehicle it is mounted on—and it has been mounted on almost every military vehicle in existence, to include a helicopter. Suffice it to say now that a crew of five is considered necessary for armored infantry use, and this point will be covered in more detail.

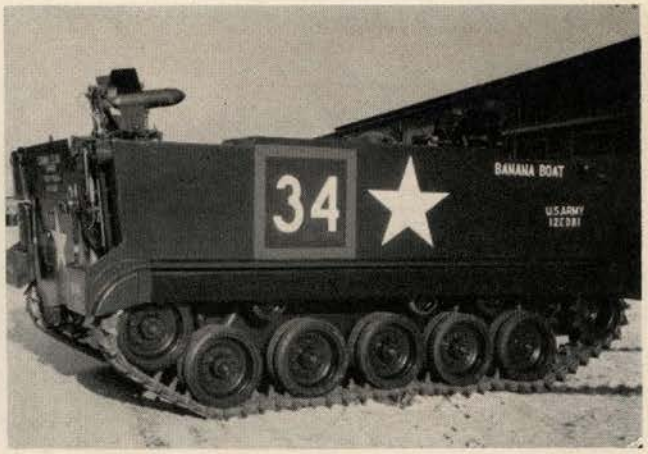
After having delineated the need for more antitank firepower in the armored infantry battalion and proposing the SS10 as the best solution, the next logical consideration is determining the method of implementation; specifically, where in the battalion is the best place for this missile and how much equipment and personnel is needed to shoot it. However, the writers desire to keep the reader's attention focused on the primary intent of the article—that of establishing a need and its solution. The exact where and how of using this missile in an armored infantry battalion is an extremely interesting matter, complex, and controversial in itself, and could well be the subject of an entirely different study. The 2d Armored Rifle Battalion, 41st Infantry, 4th Armored Division, recently conducted a study and test to determine an answer to this question, and to devise a method of mounting an SS10 on an armored personnel carrier. In order not to leave this subsidiary area of the primary topic uncovered, we will briefly relate the results of this study.

It was found that there were three places in the battalion structure that might possibly be considered for the SS10. The first added a missile squad to each rifle platoon making 12 in the battalion. This was rejected as being too unwieldy for a hard-hitting rifle platoon and would constitute to the platoon leader more of a burden than an asset. Another concept established a missile platoon of six squads in the battalion headquarters company. Since this weapon must be employed on the forward edge of the battle position rather than from a battalion rear area, it follows that the squads would habitually be



(U. S. Army)

In position and ready to fire. The platform is locked in place and final electric connection is made from inside.



(U. S. Army)

The gunner is located forward in the vehicle commander's compartment. The crew performs all jobs while buttoned up.

attached to the rifle companies or in their area under battalion control. This procedure is a step backward and denies the progress in decentralization of small unit tactics. The recommended solution is a compromise between the two previous solutions. It places a two-squad missile section in each company mortar platoon. This unit then becomes, in function and nomenclature, the company weapons platoon. At company level it could be utilized throughout the company sector, and decisions concerning its employment would be made by the company commander. Considering aggressive employment, span of control and size of operational area, this is apparently the best employment of the weapon.

When the study considered ways of using this weapon without adding personnel spaces to the Tables of Organization and Equipment, no acceptable solution was found. The testers concluded without hesitation that the SS10 was valuable enough to displace some other weapon or function if that was the only way it could be "bought." However, the battalion TOE is the minimum essential now, and to integrate the antitank missile at the expense of a rifle, machine gun or mortar squad is wholly unsatisfactory.

At that point in the project the physical location of the mounting of a missile system on an APC was to be solved. The 2d ARB, 41st Infantry, asked for the support of a missile squad from the A Battle Group, from the 19th Infantry, 24th Infantry Division. This unit already had SS10's that are jeep mounted. With their assistance, and with the inspiration of a top-notch battalion welder, a rotating platform was devised for the missile. The rear portion of the carrier's top deck was unbolted and removed. Two small beams were installed across the width of the vehicle along the front and rear of the opening thus made. On these beams pillow blocks were fixed to receive the pivots of the rotating platform. Launching frames were then secured on top and bottom of the platform. A latch and cable connector were added and the whole was carefully balanced. Installation of the guidance equipment with the control box at the vehicle commander's hatch completed the improvisation. The rearward placement of the launcher allows ammunition storage in the forward portion of the troop compartment. It is possible to carry a combat load of 12 missiles inside the vehicle.

This missile system on an armored personnel carrier requires a crew of five: vehicle commander; driver; two loaders; and one ammunition handler. The vehicle commander is the gunner. The driver also has the additional duties of power and communication operator. The two loaders mount and connect the missile for launching. The ammunition handler removes the rockets from the carry position and makes initial firing preparation.

In operation, the installation allows internal loading and external firing. The ammunition handlers function in the forward part of the compartment at the ammunition stack. The two loaders are directly beneath the rotating launching platform. While one missile is being guided to the target, they attach another missile to the launcher which is then underneath inside the vehicle. Back blast is negligible and a small shield adequately protects the gunner from the missile as it flies over his head.

In positions where it is desirable to put the APC in defilade, a portable control box is carried by the gunner to a position from which he can observe the target and control the missile. In this case the missile may be fired from the ground. The APC still furnishes power and communication from its defilade position.

With the successful mounting of the missile on the APC, the task of the 2d ARB, 41st Infantry, was complete. The test and study, with resultant conclusions, indicated a definite need for more antitank firepower in the armored infantry battalion. It was further concluded that the French SS10 antitank guided missile, or its successor the SS11, met the requirements for the task. A specific mechanical adaptation to the APC and a method of utilization was likewise found. A command of execution is now recommended.

NEWS NOTES

A New Educational Center at Knox

Registration for the fall term of the newly established University of Kentucky residence center at Fort Knox is underway.

The University of Kentucky Board of Trustees agreed to establish the center. Agreement came following an earlier recommendation by the University's Faculty Board. The University and Fort Knox officials have been discussing the program since 1954.

Registration will run through September 18 at the Education Center where the U. K. offices will be. Classes will also meet in the Education Center and in Armor School classrooms Monday through Thursday evening with two one-hour-and-20-minute sessions each evening.

50 percent of the instructors will be full-time university employees with the remaining from the Fort Knox area.

Rules and regulations will be the same as those at U. K. Students taking freshman and sophomore courses will be able to earn up to 67 credit hours acceptable at any college. All military, dependent and civilian personnel at Knox who are qualified for college work will be eligible to attend.

According to Mr. Jones, Army Eduaction Center supervisor, military personnel eligible for government tuition assistance will pay $5.25 for a three credit hour course. Without tuition assistance the cost will be $21.

Jones says the University of Louisville, Bellarmine and Nazareth College programs will continue to be offered to Knox personnel along with the USAFI night program.

To Germany

More than 1200 trainees and 400 permanent party personnel from the 6th Armored Cavalry Regiment have been alerted for movement to the 11th Armored Cavalry Regiment in Bavaria, regimental officials here announced.

The replacements are expected to leave Fort Knox in three groups during September, October and November.

The personnel scheduled to rotate to Bavaria, almost without exception, had all volunteered for the 6th Cavalry's Operation Gyroscope to Bavaria. When the gyroscope move was cancelled, the volunteers were given the option of joining the 11th Armored Cavalry.

Personnel not going to Bavaria will remain here with the regiment, be assigned within the Continental United States, or in some cases be assigned to other units in the European Theater.

To date, 80 regimental personnel have been assigned to the 3d Howitzer Battalion, 3d Artillery here and 79 have been assigned to the 3d Armored Cavalry at Fort George Meade, Maryland. Assignments are also expected to the 4th Infantry Division, Fort Lewis, Washington.

The regiment's present activity is centered around preparing men for their new assignments. All the regiment's 1900 trainees have finished advanced individual training and many are now taking their last leave prior to overseas assignments.

The 11th Armored Cavalry, destination for over half of 6th Cavalry personnel, is located in the Bavarian towns of Regensburg, Straubing and Landshut. The primary function is patrolling the border between Germany and Czechoslovakia.

The Draper Competition

If commanders of tank units in the 4th Armored Division have been watching the performance of their men just a little more closely recently, it is with good reason. They are looking for the sharpest platoon in their outfit for representation in the Armor Leadership Award competition slated for 1-10 November.

The Armor Leadership Award, originally founded by Colonel Wickliffe P. Draper in 1925 to stimulate competence in cavalry units, is now awarded on a rotating basis among armored divisions.

This year, the competition has been designated by General Bruce C. Clarke, United States Continental Army Commander, to take place among battalions of the 4th Armored Division.

In preparation for the division-wide competition, tank battalion and reconnaissance squadron commanders are required to select a tank platoon for entrance in the contest no later than 10 September. It has been further stipulated that competing platoons must have attained a satisfactory rating on a platoon test after 1 July.

The actual competition, to be held at the Grafenwoehr training center, will include physical fitness testing, a military stakes course, individual arms firing, combat readiness inspection, tank crew proficiency course, various tactical phases and a post operations inspection.

The winning platoon will receive a 12½-inch high trophy of silver and Belgian black marble, surmounted by a silver tank. Individual members will receive separate awards.

Major General O'Hara Assumes New Post

Major General Almerin C. O'Hara, Commanding General 27th Armored Division, New York Army National Guard, was appointed Chief of Staff to the Governor of New York on the 20th of August. In this capacity he will command the 35,000 troops of the State Militia Forces: The New York Army National Guard; the New York Air National Guard; the New York Naval Militia and the New York Guard, which was reorganized last year as a reserve military force should the New York Army National Guard be called into Federal service. He succeeds Lieutenant General R. C. Brock who recently retired.

General O'Hara will continue to command the 27th Armored Division until a successor has been named.

Plastic Glue for Damaged Bones

A plastic glue designed to repair damaged bones and put a patient back on his feet in 48 hours is under development by the Army Medical Service, the Department of the Army announced recently.

The substance, a polyurethane foam, may greatly reduce the length of time of hospital care for the wounded soldier. It would be particularly important to the Army since at least 60 percent of combat casualties have suffered bone fractures.

Army specialists term this type of treatment "experimental" at this time.

The plastic, a polyurethane polymer, is a foam, which solidifies into a porous, rigid substance when applied to a fracture, bonding the bones together until bone cells grow through the material. Over a period of several months the body completely replaces the plastic with natural bone.

The plastic is applied by opening the fracture site and packing the polyurethane around the broken or diseased bones. In addition to "glueing" broken bones, the substance can be used to replace fragments of damaged bone. It is moulded by the surgeon to match the original bone contours.

The foam has no immediate toxic effects, but its long-range effects on the body are not yet fully understood. Army researchers are now engaged in "tagging" the polyurethane with a radioactive isotope "tracer" in order to learn what happens as it disappears from the fracture site.

The plastic has been extensively evaluated by Captain Joseph Salvatore

at the Department of Experimental Surgery, Walter Reed Army Institute of Research, Washington, D. C. Captain Salvatore, and Dr. Michael Mandarino, an orthopedic surgeon at Hahnemann Medical College and Hospital, Philadelphia, Pennsylvania, first applied the foam substance to bone-mending several years ago. When Captain Salvatore entered active duty with the Army, he was encouraged to bring the project with him and explore its potentialities for military medicine.

New Shipping Container for STRAC

A new lightweight, low cost fiberboard container has been designed to enhance the mobility of the Army's STRAC forces for immediate deployment.

The containers would be packed with organizational and personnel equipment of STRAC units, properly documented and stored in constant readiness for movement on short notice. When units move by air, the pre-packed containers would be rushed to waiting aircraft.

The new container, with pallet attached, is expected to provide a 60 percent reduction in packing and crating materials, as well as savings in time and weight. It is designed for use with the Army's standard reusable steel CONEX (Container Express) shipping container. Six of the new containers would be loaded into the 365-cubic foot CONEX container for shipment by rail, ship or truck.

The new shipping boxes are constructed of weather resistant, triple-wall corrugated fiberboard, can be stored indefinitely in closed areas or out of doors for short periods with good results. Manufactured in two sizes, the containers have a capacity of 1000 pounds. One container measures 58 inches long, 32⅞ inches wide and 28¼ inches high. The other is 45 inches long, 32 inches wide and 28¼ inches high.

Although classed as an expendable item, it may be possible to reuse the container due to the rugged semi-rigid construction. They can be transported slung from helicopters or in cargo aircraft.

The Army Transportation Research and Engineering Command, Fort Eustis, Virginia, has procured more than 4000 of the versatile containers for testing by STRAC units. The containers were developed by Tri-Wall Containers, Inc., of New York, N. Y.

Army Air Defense System Being Deployed Overseas

Overseas deployment of a new tactical air defense system for battalion-level control and coordination of missile batteries in a field army was announced recently by the Department of the Army.

Designated the AN/MSQ-18 by the Army Signal Corps, the system gives the air defense commander in the field immediate control over antiaircraft missile batteries, even though they are dispersed over a wide area. (See page 57.)

(British Information Services)

The Thunderbird is the first British designed-and-produced missile to go into service with the British Army. Used as an antiaircraft weapon it has a rocket motor and jettisonable "wrap-around" system of four rocket boosters.

Army Radar Set Improved Through Use of Transistors

An Army radar set, which can detect enemy movement at short ranges under the cover of darkness, smoke or fog, has been greatly improved through the use of transistors.

Known as the Silent Sentry, AN/PPS-4, the improved set was displayed for the first time at the annual meeting of the Association of the U. S. Army.

Power requirements for the improved version are reduced by half by switching from tubes to transistors. The new set will use a battery instead of the gasoline generator. Elimination of the noise-making generator enhances the silent characteristic of the small radar and results in improved maintenance and logistics.

First disclosed in 1956, the highly-mobile Silent Sentry is both rugged and light. Movements of tanks, trucks or troops are translated into identifiable sounds produced in the headsets worn by the soldier operator. Using these "electronic ears," the operator is able to pick out and pinpoint the movement of targets within an area up to three miles.

The radar greatly reduces an enemy's prospect of obtaining the advantage of surprise. The set can detect the difference between a walking and a running man.

Development of the transistorized version of the Silent Sentry is the result of a joint program by the U. S. Army Combat Surveillance Agency and the Sperry Gyroscope Company of Great Neck, New York, which was recently awarded a $3.5-million production contract for the equipment.

Advanced Electronic Scouting

Elements of an advanced Army method of electronically scouting the enemy were disclosed for the first time in a three-dimensional activitated display of the AN/USD-5 Surveillance System. The Army Signal Corps display, shown at the annual AUSA show, revealed a mobile ground complex controlling the flight of a jet-powered, delta-wing drone.

The system is in an advanced state of development by Fairchild Engine and Airplane Corporation, prime contractor for the U. S. Army Signal Research and Development Laboratory at Fort Monmouth, N. J. General mission of the system is to extend the capability of the battlefield commander for what is described as "long endurance" surveillance and for target acquisition.

The ground complex consists generally of launching and recovery vehicles and trailerized computer and control centers which receive and process data gathered by the drone. The jet drone carries electronic equipment capable of gathering and transmitting in a variety of methods data on enemy positions and movements. The display depicts the drone scanning three typical, dispersed tactical targets and transmitting information back to an Army commander located on the reverse side of an intervening mountain. The day and night, all-weather capability of the system is represented.

Fairchild Engine and Airplane Corporation has been developing the AN/USD-5 system under an Army Signal Corps contract.

ASSISTING
THE FOREIGN STUDENT

By LIEUTENANT COLONEL HERSCHEL H. HUTSINPILLER

TRAINING a diversified assemblage of students from widely separated parts of the world and, at the same time, gaining their goodwill by imparting to them a better understanding of the United States . . . is a task of considerable magnitude.

Examination of the foreign military training program of the U. S. Army Armor School at Fort Knox, Kentucky, provides ample evidence that a service school, with adequate planning, can meet this challenge with notable success. A measure of the School's success in this field is the good academic records turned in by the majority of its foreign students and the regret they invariably express at the inevitable termination of their tours.

Some 51 nations have sent students to the School. The Republic of Korea has sent a greater number than any other single country, a total of 144 students, and Canada is second with a total of 115. Current foreign training input averages approximately 200 students per year from 35 to 40 different countries. The scope of this challenge can be understood better when it is realized that the students have ranged from Private to Brigadier General in rank, and that fluency in English varies from the barest grasp of conversational language to complete fluency.

Primary responsibility for assisting in the management of foreign students rests with the Foreign Liaison Branch of the Office of the Secretary. The Branch is headed by an officer, and it is staffed by enlisted men who are fluent in various languages. The phrase, "to assist the foreign student in any way necessary," best summarizes the work of the Branch.

In general, the foreign military training program at the School can be considered as consisting of two major elements. The first part is the purely training, or academic, phase. The training mission is, of course, the principal "reason for being" for the entire program. The second component part of the program is the support and orientation phase. This component, designed to make the student's stay as pleasant as possible and to impart to him a better understanding of the United States, is the "bonus effect."

First, let us examine the academic phase of the program. Foreign students attend nearly all the courses offered by the School. It is difficult and challenging for them, the majority of whom are handicapped by language deficiency to some degree, to compete successfully in instruction which is given in English and which is designed primarily for American personnel. Yet nearly every foreign student successfully completes his course. Such success reflects favorably upon the students themselves, and upon the School for organizing its instructional program in a manner which enables it to put across its instruction to the foreign students.

Whenever possible, the foreign student is issued lesson plans for coming units of instruction. These plans are a valuable aid to the student. They serve as a framework around which he can accomplish his preparatory study. Thus, he has the teaching points already fixed in his mind when he arrives in the classroom. Since he has familiarized himself with the subject matter to be taught, he is able to absorb far more of the classroom instruction than would be possible without such preparation.

A student who realizes that he does not have a good understanding of any phase of instruction may receive additional instruction merely by asking. (The same assistance also is readily available to any American student.) If the student wants to learn, the School stands ready to give him all the assistance of which it is capable. The greatest difficulty which we experience is that some foreign students hesitate to seek this additional assistance, and considerable effort is required to impress upon them that a request for additional instruction

LIEUTENANT COLONEL HERSCHEL H. HUTSINPILLER, Armor, a 1939 graduate of the University of Michigan, served in Europe during World War II. Subsequent to the War he served in Rumania as Assistant MA. Returning Stateside he attended school at Knox and went to the 1st Armored Division. He is now the Chief of the Allied Branch at the U. S. Army Armor School.

is not an admission of inaptitude.

Foreign students take the same examinations as do their American classmates, except for those on classified units of instruction. The only difference is that the foreign student may utilize for writing that time which normally is devoted to a critique of the examination. This additional time is of benefit in assisting him to compensate for his language handicap. Also, whenever possible, interpreters are made available to explain terminology which the student does not understand.

Each foreign student's academic performance is monitored on a continuing basis by the Foreign Liaison Branch. As soon as it is noted that a particular student is having difficulty, the matter is referred to his faculty sponsor, who is asked to counsel the student and arrange additional instruction or other corrective action. The sponsor is a member of the staff and faculty who has volunteered for such a detail and who has been designated to serve as the student's advisor and "friend."

Considerable perception is required on the part of the sponsor, for a foreign student's problem cannot always be written off in a perfunctory manner as "language." Other factors also must be considered. Sometimes, the student's study habits are faulty, most frequently because he is overdoing it. Or, he may not be orienting his study toward the material of greatest importance. Sometimes, the sponsor can solve his student's problems by arranging for him to study with an American student, or in a group with fellow students from his own country.

An important opportunity would be lost should the foreign student do nothing but "go to school" during his stay in the United States. To capitalize on its opportunity, the School has given special consideration to the ways and means of generating goodwill toward the United States on the part of the student. A "soft sell" approach has proved to be most effective in winning friendship, thereby establishing throughout the free world a hard core of friends which could prove of inestimable value to the United States. Merely enabling a student to gain a better understanding of the United States normally is sufficient to establish him as an ally. Smoothing the way for him administratively and making his stay as pleasant as possible usually are sufficient to establish a receptive attitude.

These considerations have guided the formation of the support and orientation phase of the School's twofold foreign training program.

From the moment the foreign student arrives, the Foreign Liaison Branch is at his service. He is met on arrival and escorted to his billets. The Branch then coordinates the administrative in-processing procedures, streamlining the process to the greatest extent possible so as to cause the student a minimum of inconvenience. Once he is installed in class, he continues to rely heavily upon the Branch for advice, assistance and guidance with regard to both personal and professional problems.

In addition to relieving the student from the inconvenience of coping with administrative problems, the Foreign Liaison Branch conducts a many-faceted orientation program to enable the student to gain a better understanding of the United States.

During periods when their American classmates are receiving classified instruction, foreign students are taken on tours of industries, commercial enterprises and historical sites in the surrounding area. These range all the way from a half-day tour to a Louisville factory or the birthplace of Abraham Lincoln to a full-day excursion to some of the famed horse farms in the Lexington area.

When time sufficient for a full-fledged tour is not available, films are shown on various phases of American history, culture and life. These films broaden the basis of the orientation program by extending the students' experience beyond the confines of the area in which Fort Knox is located. Although civilian support of the orientation program will be outlined later, it should be pointed out here that the films used in the orientation program are provided by the Louisville Free Public Library.

Of course, everyone requires relaxation and diversion. Foreign students, therefore, are encouraged to join in post social activities as integrated members of the military community. Continuing publicity in post information media is utilized to draw attention to the foreign student body. This device generates interest, which results in numerous home invitations being extended to the foreign student. Their sponsors also participate in this effort. Local units such as the Sixth Armored Cavalry Regiment and School Troops invite foreign officers and wives as guests to unit social activities. Not only do such invitations serve as a pleasant respite for the foreign student, they also allow him to see American home life at first hand, and thereby to understand us better.

An orientation program based en-

(U. S. Army)

Representatives from Burma, Austria and Japan review radio procedure.

tirely upon the military community could not give a complete picture. From this standpoint, the School has been fortunate in obtaining strong support in its orientation program from the surrounding civilian community. Organized civilian support was initiated when "Operation Hospitality" was set up in July 1954, with the Louisville Chamber of Commerce activating the necessary civilian promotion. Approximately 30 civic organizations regularly invite foreign students to their dinners and meetings under the auspices of "Operation Hospitality." A member of the organization meets the guests on arrival, and serves as their host for the affair.

On occasion, however, the foreign students find that they must earn their way. Because of their varied and interesting backgrounds, they frequently are asked to appear as guest speakers before the various organizations. This turning of the table has the beneficial effect of helping to convince the foreign student that the people of the United States are interested in his country.

Generous support also has been received from the families of the civilian community. Many make it a practice to regularly invite foreign students into their homes. Thus, the student is afforded the opportunity to compare civilian home life in the United States with that of the military and with that of his own country. In some cases, the ties become so close that the foreign student finds himself practically adopted into the family.

Recognizing that a "worried mind" is not conducive to good academic work, the School and the ladies of Fort Knox have banded together to ease the problems of students who bring their families to the United States. Although foreign students attending service schools are not encouraged to bring their families, a number do arrive complete with family circle.

Families arriving at Fort Knox find that every effort is made to help them establish themselves in their new country. Ladies of the International Group of the Women's Club are on hand to help the distaff side set up housekeeping in her strange surroundings. When shopping is to be done, the lady of the house knows that she always may depend upon the expert advice and assistance of an American helpmate, volunteering her services.

(U. S. Army)

Families from Norway and Greece get a look at a Louisville industrial plant.

Also, the foreign wife need not worry about lonely hours while her husband is in class. The International Group and other elements of the Women's Club see to it that she has a full quota of coffees, teas, tours, language lessons and special interest activities.

Assisting with "family problems" has paid good dividends by freeing the student to concentrate on his studies.

A number of other devices are used to make the foreign student feel at home and that he is accepted as a member of the installation. For example, he receives a signed greeting card from the Assistant Commandant on his major national holiday. He and his foreign classmates are interspersed among American personnel, both in billets and in class. He participates in class activities on the same basis as his American classmates. On graduation, he receives, in addition to his diploma, a scroll which certifies to his qualifications to wear the School's Foreign Officers Emblem, a specially-designed badge which features the familiar triangle of the Combat Arm of Decision. He also receives a class souvenir booklet, which contains a photograph of his foreign classmates and their permanent home mailing addresses.

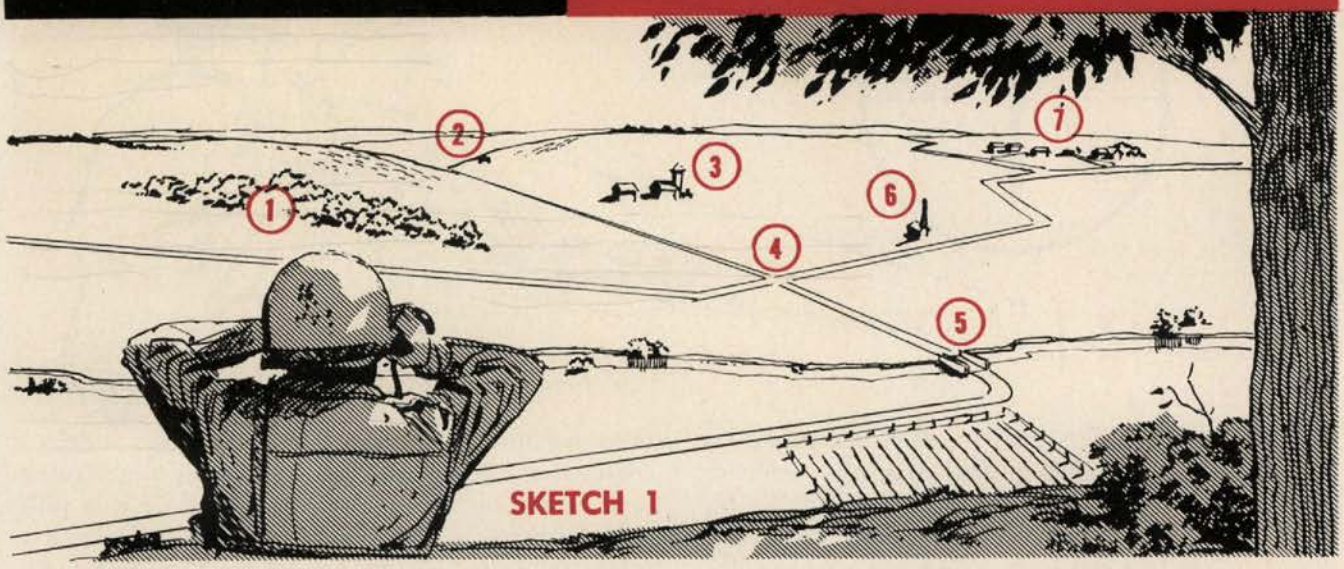
Attention also is given to the requirement for physical exercise. Those who wish to do so may utilize the various athletic facilities available on the post. The soccer addict, however, need not feel neglected. Foreign-born members of the Foreign Liaison Branch have organized the "Internationals," a soccer team composed of foreign students. The newly-organized club launched into a three-game season last Fall with nearby colleges, winning two and losing one.

Thus, the U. S. Army Armor School makes a studied effort to turn out foreign students who are well trained professionally and who have a better understanding of the United States. Letters and cards from the alumni prove that they hold their alma mater in high esteem. Living proof is a young boy in South America who bears the name of the Kentucky installation. His father, a former student, named him *Knox* as a token of esteem.

Not all situations, however, lend themselves to ready solution. Nothing could be done for a student who arrived recently. Prior to his departure from his country, a fellow officer who had been a student at the School (where he had earned the appellation "bandito") generously offered his expert services in the repacking of luggage to eliminate nonessential items. The hapless victim arrived at Fort Knox with one uniform, a sports shirt, a pair of bluejeans and . . . . blood in his eyes.

How Would You Do It?

US ARMY ARMOR SCHOOL PRESENTATION



SKETCH 1

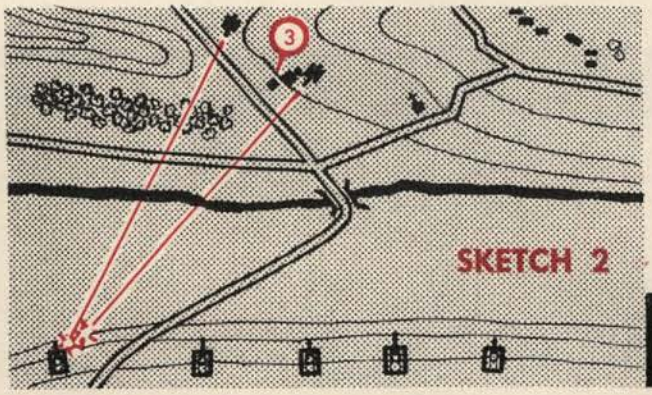
Situation 1

1st Medium Tank Battalion (Patton), 1st Armor (Task Force 1/1), a part of Combat Command A, 301st Armored Division, has been ordered to occupy defensive positions in preparation for continuing the attack to the north.

Team B (Company B, 1/1 Armor, with one armored rifle platoon attached), has been assigned defensive positions overlooking a major road net (sketch 1), access to which, according to friendly civilians, is covered by numerous enemy antitank guns. In view of this, the commanding officer of Team B has directed that tanks will be kept in turret defilade during daylight and moved into prepared positions after dark. Range cards for each tank and unit fire plans for covering the approaches into the defensive positions are to be prepared and coordinated prior to darkness.

Problem 1

You are Platoon Leader, Third Platoon, Team B.



SKETCH 2

Your commanding officer has directed you to keep your tanks in turret defilade during daylight and move them to prepared firing positions after dark. Third platoon targets are numbered 1-7 in sketch 1.

What equipment and procedures will you use in preparing range cards for your tanks?

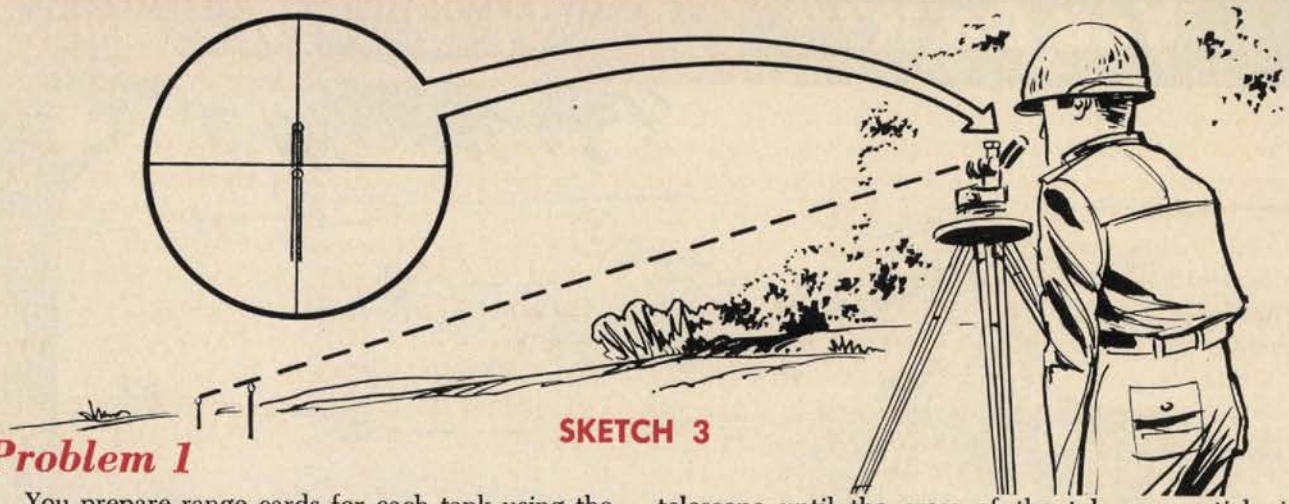
Situation 2

You have selected firing positions and prepared range cards for each tank of your platoon, and, after dark, four tanks moved into position without encountering difficulty. However, at 2025 hours, as your fifth tank was pulling into position, it was fired on by what appeared to be two antitank guns located near target 3 (sketch 2). You call for artillery fire on these guns and are satisfied that at least one of them was neutralized or destroyed. However, as your crews continue to improve their positions, one of your tanks is fired on and hit by what you determine to be the remaining antitank gun. Your tank commanders report that they observed the muzzle flash of the gun at approximately 50 mils to the left of and at about the same range as target 3. You decide to engage this weapon. Commanding Officer, Task Force 1/1, has stated that plans for renewed offensive operations preclude the use of illumination in the area.

Problem 2

What method of fire and adjustment will you use to engage the antitank gun?

AUTHOR: CAPT C A WOODS
ILLUSTRATION: MR J H BAIN



SKETCH 3

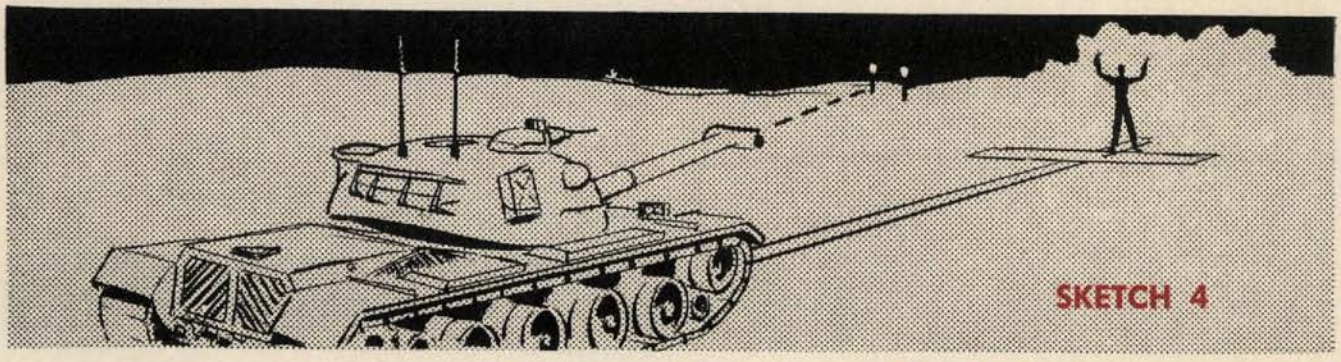
Problem 1

You prepare range cards for each tank using the M2 aiming circle organic to your company. Selecting the location to be occupied by each tank, set up the aiming circle at the exact spot from which the tank is to fire. Place two stakes, to which are attached illuminating devices or filtered flashlights, in line approximately 50-100 yards from the aiming circle at an angle that prevents the enemy from observing the illuminating devices. Sight through the telescope and zero the aiming circle on the stakes, thus establishing a line of zero deflection. The stakes are now the reference point for the range card position (sketch 3).

Using the upper (recording) motion of the instrument, traverse to each known and likely target to obtain the mil reading. The reading shown on the azimuth and micrometer scales must be subtracted from 3,200 mils because the instrument is graduated clockwise, and the tank azimuth indicator is graduated counterclockwise. The result is the deflection to the target and is the actual azimuth indicator reading. To determine quadrant elevation, first determine the range to the target using the best means available. Obtain the mil elevation for that range from a graphical firing table, tabular firing table, firing data chart, or the ballistic computer on your tank. Using the telescope of the aiming circle and the elevation scale, determine the angle of site in mils. Center the bubble of the telescope level vial and elevate or depress the telescope until the cross of the telescope reticle is centered on the target. The reading on the elevation scale is the angle of site to the target. If it is plus, it is added to elevation for range. If it is minus, it is subtracted from elevation for range. The result is the quadrant elevation for the target. If the result is a fraction or decimal, it is rounded off to the nearest whole mil. This procedure must be repeated at each tank firing position for each target.

When the range card is completed, each firing position is marked with engineer tape or other suitable material (sketch 4). Each tank will be positioned where the long axis of the "T" intersects the crossbar and will follow the long axis of the "T" to reach the position.

While the tank is moving into position, the loader will sight through the gun tube to align the lights on the stakes one above the other. When he can observe the lights through the tube, he will take command of the tank and direct the actions of the gunner and driver until the lights are in line. When the gun is aligned on the lights (stakes) the gunner will zero his azimuth idicator. Now, by traversing the deflection noted on the range card and applying the necessary quadrant elevation to the gun, the gunner can fire on all targets plotted by the platoon leader for this position.



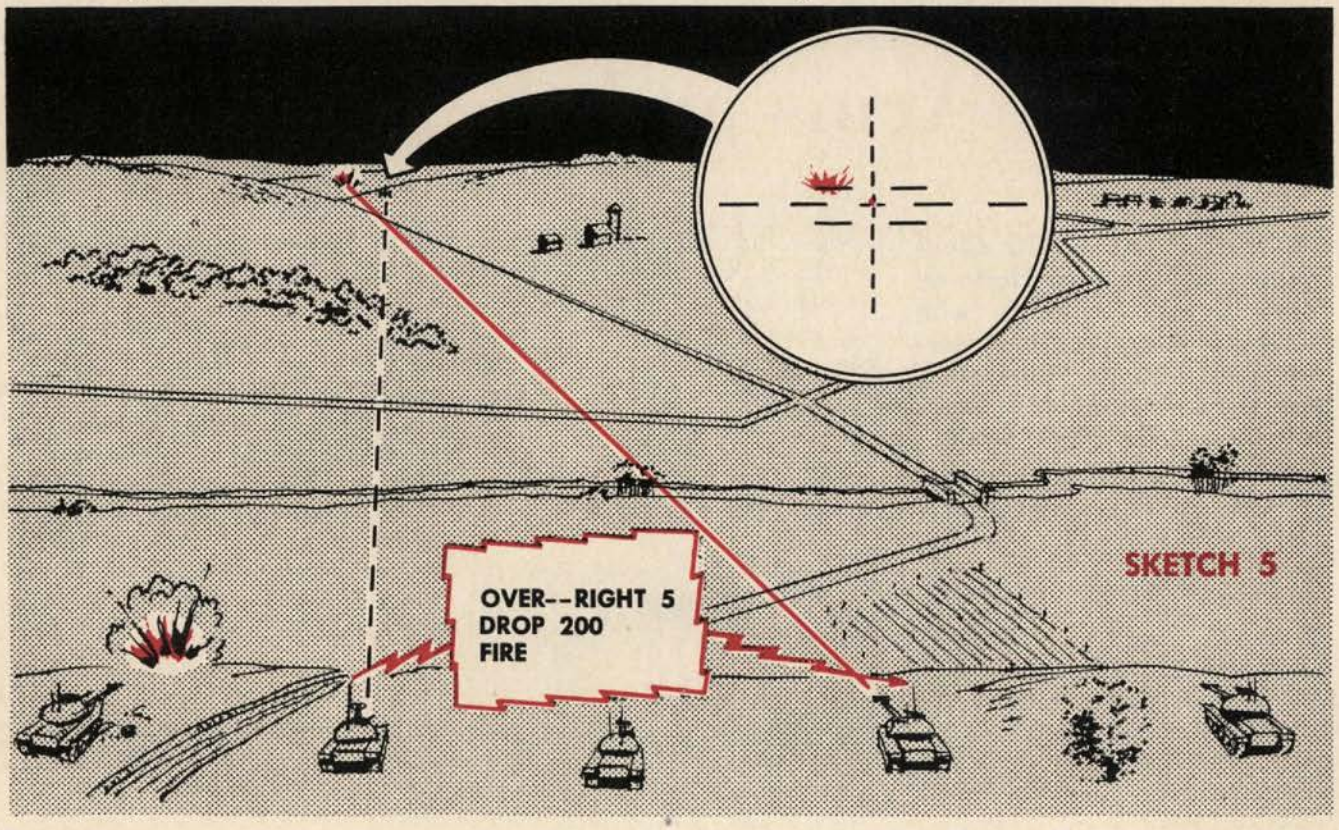
SKETCH 4

Problem 2

Since all of your tanks have located the flash of the antitank gun, you decide to engage the gun using the two-tank method. You designate tanks 2 and 4 to participate, with tank 2 as the firing tank and tank 4 as the observing tank. Upon observing the muzzle flash of the antitank gun, both tanks will lay on the target (flash) with the illuminated reticles of their direct fire sights. The gunner of each tank will zero his azimuth indicator and tank 2 (firing tank) will index the quadrant elevation for target 3 and center his quadrant bubble by elevating or depressing the gun. Tank 2, after ON THE WAY has been announced over the platoon radio net, then fires, and though the gunner of tank 2 is temporarily blinded, the tank commander of tank 4, being distant from the flash, observes the burst in relation to his aiming cross, which is on target. He announces a sensing and subsequent fire command to the firing tank (sketch 5).

Having previously zeroed his azimuth indicator on the target, the gunner of tank 2 can easily traverse right 5 mils using his azimuth indicator to make his deflection correction. To apply the range correction, he must convert the announced range change to mil elevation to be applied to his quadrant. To do this he may again consult the firing tables and obtain mil elevation for the new range. However, a faster method may be used by applying the C-factor. The C-factor is the amount of change in mil elevation required for making a 100-yard range change on the ground. For all practical purposes, the C-factor for 76-mm and 90-mm tank guns is one mil. So, for each 100 yards of range you wish to change, you must add or drop one mil of elevation. To drop 200 yards, tank 2 will subtract two mils of elevation on his quadrant and center the quadrant bubble by depressing the gun. When ready, he will announce ON THE WAY and fire again.

This type of fire and adjustment will continue until target neutralization or destruction is obtained.



Discussion

The M2 aiming circle is a member of the tanker's family of auxiliary fire control instruments. One of these instruments is organic to each ROCAD tank company. The preparation of range card data is only one of its many uses. The armor unit commander must be prepared at all times to use any one or a combination of tools available to him to assist in the successful accomplishment of his mission.

At night, targets of opportunity should be engaged by applying range card data whenever possible. The use of tanks in pairs under periods of reduced visibility, one to observe and the other to fire, greatly enhances the probability of fast neutralization or destruction of hostile weapons. War is fought around the clock, so we must be prepared to fight our tanks at night as well as during daylight. We have the equipment that enables us to fight our tanks under all conditions of visibility; proper training in the use of this equipment will bring success in battle.

THE BOOK SECTION

Part I is "essentially an extensive introductory or background piece" examining American civil-military relationships during the period 1931-1945—that is, from the Manchurian crisis to V-J Day: "the 15 years that seem to have laid the main groundwork for what has followed."

Arms and the State: Civil-

ARMS AND THE STATE: Civil-Military Relations in National Policy. By Walter Millis, with Harvey C. Mansfield and Harold Stein. 436 pp. The Twentieth Century Fund, New York City, New York. 1958. $4.00.

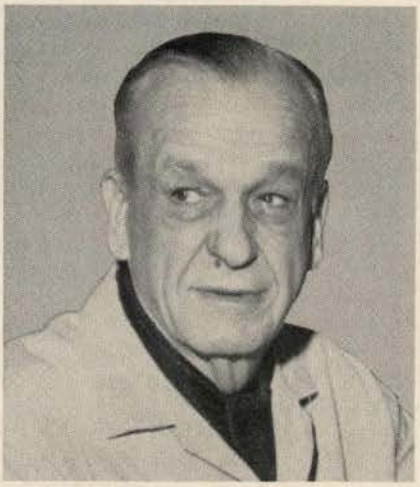
Reviewed by George Fielding Eliot

THIS is a book which asks questions to which its authors do not presume to supply any neatly packaged answers.

Hence it is a book which invites the reader to think for himself, which sets him searching for his own answers. In this quality of intellectual stimulus lies the great value of the work Mr. Millis and his colleagues have produced.

The main subject of inquiry is the relationship between civil and military factors in American government and policy during the 12 years 1945-1957. This, as Mr. Millis points out, is not a question of civilian control of the military in the old sense, but rather one of proportion between the strategic and non-strategic factors in the formulation of national policy. The fundamental issue has remained constant and unresolved. It is with us today as the authors see it in 1945 —"whether the technical, military advice as to force levels, weapon systems, expenditures, could be combined with the political, civilian advice as to diplomacy, budget and tax policy and popular acceptance into a coherent and adequate national strategy on the world stage. The real issue was not between the civilian and the military. It was how to balance a proper combination of the non-strategic or non-violent with the strategic or violent components of national policy. It was with this issue, seldom clearly seen, that the history of the ensuing decade was to be concerned."

THE REVIEWER



GEORGE FIELDING ELIOT, well-known author, military analyst and syndicated columnist, writes the column entitled *The Military Scene*. Also he is an analyst for the Mutual Broadcasting System.

The book is admirably organized for its purpose. Part I is "essentially an extensive introductory or background piece" examining American civil-military relationships during the period 1931-1945—that is, from the Manchurian crisis to V-J Day: "the 15 years that seem to have laid the main groundwork for what has followed." Part II provides a critical and clinical analysis of the attempts to solve the problems of these relationships in the post-war—or rather the "cold war"—years: the opening years of the atomic era.

As World War II ends, the authors find the tasks of American policy still bedevilled by insistence upon separate categories of "purely mili-

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

Benjamin Franklin

Part II provides a critical and clinical analysis of the attempts to solve the problems of these relationships in the post-war—or rather the "cold war"—years: the opening years of the atomic era.

Military Relations in National Policy

tary" and "purely political" considerations. One startling example which they present is the frustration of the State Department and Ambassador Winant in repeated attempts to get hard-and-fast agreement from the Soviets on a Western corridor to Berlin because the Civil Affairs Division of the War Department insisted that this was a purely military matter to be settled on the "military" level, and stating "that it would be unwise for the Army to commit itself in advance to any particular route." This reasoning seems to have been based on an "easy assumption that we could always count on passing through the Soviet zone anywhere at will, or at least could count on stipulating any convenient route later"—an assumption which contributed to the lack

THE AUTHORS

WALTER MILLIS, editorial and staff writer for 30 years on the *New York Herald Tribune*, is also author and editor of several books. His latest: *Arms and Men.*

HARVEY C. MANSFIELD is chairman, Department of Political Science, Ohio State University. He is also the editor of the *American Political Science Review.*

DR. HAROLD STEIN is lecturer of Public and International Affairs, Princeton. He was deputy director of Office of War Mobilization and Reconversion.

of definite written agreements to support our position at the time of the Berlin blockade.

A distaste for the political considerations of strategy had become traditional in U. S. military doctrine; the policies which the soldiers were called upon to execute took their political coloration from civilian decisions. And those policies were based on a civilian assumption far more disastrously and fundamentally erroneous than anything conceived by the military: events were to belie "the basic premise of our wartime political strategy, that with Germany and Japan beaten the three victorious powers could work out the remaining problems harmoniously through the instrument of a universal international organization."

"By the time the war was over," observes Professor Mansfield, "two very different images of the post-war world were taking shape in outline; blurred as they were they counselled sharply contrasting courses of action by the military toward our allies as well as toward our defeated enemies." It is possible to agree that "to the clarification of these choices, the traditional military doctrine contributed chiefly confusion," but American military officers were used to the unquestioning acceptance of political objectives rather than helping to formulate them. The need for a *constant* weighing of military considerations in the day-to-day formulation of national policy—the existence of a "continuing threat," as President Eisenhower has recently remarked—was something as new to the American civilian as to the soldier.

But the new issues soon made it clear that "neither civil nor military policy could prosper in isolation"—only a few years later we find an informal agreement between Secretary of State Acheson and Secretary of Defense Marshall that any of their assistants who used the phrase "purely military" or "purely political" would be required to leave the room at once. Military men began to take political considerations into account, and to display considerable capacity in political appointments. The National Security Act of 1947 set up a new relationship of the civil and military components within the government which gave recognition to the increased importance of "the common defense" in accordance with the omens of the times.

Yet nothing could dispose of the stubborn fact that "preparing for war presents very different problems than does the waging of it," and not the least of these problems was the question of how much money for defense, and how much for each of the three services—the Air Force now having attained co-equal stature with the Army and Navy. Mr. Millis has caustic criticism of the budget process set up under post-war legislation—"there was no point at which the soldiers were not being ridden by the civilian budget-makers, and no point at which the latter were not being ridden by the soldiers, with neither in a position of clear responsibility for the results." However, the budget people have the last word: their annual task has been "to squeeze the whole thing under a predetermined ceiling . . . by hunting out what to their civilian minds look like military 'non-essentials' . . . deferring everything deferrable regardless of the effect on long-range planning."

It is very clear that Mr. Millis does not believe that this system—or perhaps any system keyed to an annual budget ceiling which is the ultimate criterion of judgment, rather than effective defense—can adequately serve the needs of a country facing a continuing threat from a powerful and versatile enemy. Many who have had experience with the system will agree with him on this point, as well as when he says, "It may be that nations, like men, will never be all-knowing, all-wise and all-powerful; and that the trinity of intelligence, policy and strategy, the one proceeding from the other, will never find any valid counterpart in the real world of desperate expedient and stratagem in face of the unexpected and the unprepared-for—the world which we seem normally to inhabit. . . . The conclusion would seem to be that neither 'purely military' nor 'purely political' wisdom, nor even the rather close combination of the two . . . can provide more than a dim guide to the future."

Yet the need constantly to face the unexpected, the need to proceed resolutely with no more than a "dim guide," is habitual to the process of military operational decision. It is the "fog of war" through which military officers are trained to advance without demanding that all be foreseen and assured. The X factor in our current military planning is not the Bureau of the Budget, but the existence of the "continuing threat"—the cold war. The element of unpredictability has its origin in decisions made not in the Executive Offices but in the Kremlin and Peiping.

In facing the dangers and anxieties inherent in this state of affairs—but little if at all removed in principle from a state of outright war—there is surely a place, if not for "purely military" wisdom, at least for military habits of thought and of decision making. And since, at the topmost levels of decision, it is the civilians who decide, the real need seems to be for civilians (notably for Secretaries of Defense) who will make it their business to see that the military factors, the military risks in any given decision or policy are fully understood and weighed. This cannot be done, as Mr. Millis points out, by a "plethora of staffs, boards and committees in which civilian and military representatives sit together, in which the civilians believe that they have to take military advice and the military believe that they must tailor the advice to civilian considerations."

It is the latter phrase which embodies this reviewer's chief disagreement with the authors. High military command has not become so "unavoidably political in its nature" that "either the Joint Chiefs have to support the policies of the civil administration or else they would have to be walled off completely from all influence over 'political' and 'economic' affairs." Toward the end of the book Mr. Millis puts his finger on the central requirement—"The deepest problems in modern governments are still not in getting answers but in asking the right questions." The line of demarcation between civil and military matters may be increasingly blurred, but that does not, cannot be allowed to mean that the military advisers of the nation must tailor their advice to political or economic considerations. It is their task to hew to the line, to make sure that the military risks are understood and faced by their immediate civilian superiors, in whose hands decision must rest.

There has been recently a most

dangerous tendency to seek smooth political sailings by getting "acceptable" military advice to support policies that are considered politically desirable. Discussing the appointment of Admiral Radford as Chairman of the Joint Chiefs of Staff in 1953, Mr. Millis observes: "It was desirable to find a JCS chairman in sympathy with the civilian policy [of emphasis on nuclear weapons and reduction in military spending] and then enhance his authority over his military colleagues. . . . If Radford was unable to resolve the serious strategic differences between the services, and if he was not empowered to command their agreement, he was at least able to give the political administration the military advice which it wanted to support its political decisions." Mr. Millis suggests that this was "probably a necessary role." Yet he seems to have no doubt that the larger measure of control sought for the Chairman was "an obvious step toward his promotion to unified command authority over his colleagues," and he observes elsewhere in the book that "a single and responsible Chief of Staff would no doubt enable the civilian administrators to transfer many responsibilities which they now find difficult and onerous, but they would be transferring power as well. The civilians might feel more comfortable, but the nation would lose the creative values of difference, of variety and of debate." He goes on to remark that "The Eisenhower Administration's solution for the problem was not a single Chief of Staff; it was to maintain the Joint Chiefs, but to 'politicize' them." A more dangerous answer for the future, when the White House may not—almost surely will not—be occupied by a President with the military acumen and experience of Dwight D. Eisenhower, is difficult to imagine. It may be urged, as Mr. Millis remarks, that "a purely military command committee, such as the Joint Chiefs, might have been so far divorced from the policies of the political administration as to invite chaos in defense policy"; but this assumes the politicians to be determined, in the face of the "continuing threat," to pursue a major defense policy with which the Joint Chiefs cannot agree.

It assumes that the political administration is not concerned with "asking the right questions" but prefers to sweep the right questions under the rug and concentrate on acceptance answers—in line with its own pre-conceptions.

The authors of *Arms and the State* have rendered a tremendous service to the American public by following their own precept—they have, throughout, tried to ask the right questions and have been reluctant to provide too many answers. The inability of the National Security Council to deal with major problems—over-emphasis on "staffing" —the history and results of popular and political obsession with nuclear weapons at the expense of conventional forces—the relation of supersecrecy to the lack of defined political objectives—the cult of "civilianization" which actually led, in 1953, to the reorganization of the Defense Department on the model of General Motors (with no apparent realization that this could not possibly work)—these are but a few examples of the stimuli which the authors provide for the thoughtful reader.

Yet one cannot help feeling that too much emphasis has been put—especially by Mr. Millis in Part II —on the difficulties, on the "blurring" of the lines of demarcation between political-economic and military considerations, with a consequent tendency to feel that there can be no such thing as clear-cut, objective military advice as to the costs and risks of alternative policies. "The central civil-military problem of our times," Mr. Millis concludes, is that "of adequately relating the popular impulses, the 'civilian' interest, to the ineluctable facts of international life and power policy." Yet he seems to accept as inevitable that military advice must be "politicized" and "supple"—in accordance with the political climate of the hour. This seems inconsistent indeed with the excellent and incisive analysis found on almost every page of the book. It is a view which invites comparison with that of Samuel P. Huntington, in the concluding sentences of his earlier work, *The Soldier and the State:*

> Upon the soldiers, the defenders of order, rests a heavy responsibility. The greatest service they can render is to remain true to themselves, to serve with silence and courage in the military way. If they abjure the military spirit, they destroy themselves first and their nation ultimately. If the civilians permit the soldiers to adhere to the military standard, the nations themselves may eventually find redemption and security in making that standard their own.

In Mr. Harold Stein's Introduction to *Arms and the State,* we find a passage which hints at agreement with Mr. Huntington rather than Mr. Millis on this point:

> Military officers form a conscious and coherent group operating within but largely apart from the larger governmental structure. Such a group has its own distinctive entrance and tenure procedures, its own traditions and group attitudes, its own sensitivity and code of privacy. It constitutes as it were a guild. . . . Wherever guilds exist, they and their titular—or real—superiors must find an accommodation that takes into account guild loyalties and convictions, along with broader interests and the need for political responsiveness *in the widest sense.* (Emphasis supplied.)

Perhaps it is in pursuing with patience and understanding the task of accommodating military loyalties and convictions, traditions and attitudes to the political requirements of the common defense and distilling therefrom a product of policy that will meet the needs of security without diluting the military values without which security and even survival are endangered, that the solution of our basic problem must be sought. This reviewer may be accused of over-laboring this one point; there is so very much of thought-provoking importance in *Arms and the State* that it seems ungracious to dwell upon a single facet of disagreement. Yet "the common defense has taken on an immediacy and urgency which it has not possessed since the early days of the Republic," and the common defense must fail us in a future hour of need if we demand of our military chiefs that they provide us with acceptable answers instead of confronting their civilian masters with the right questions.

Invasion '44

The story behind the invasion of Normandy, the largest amphibious assault in the history of man. The story of four years of planning and solving the problems involved in the attack, and of the strength and bravery of the allied armed forces who gave their lives for its cause.

John F. Turner **$4.50**

That Devil Forrest:

Life of General Nathan Bedford Forrest

A reset edition of the 1899 biography, with 53 of the original illustrations, 21 new maps, and a foreword by Henry Steele Commager.

John A. Wyeth **$6.95**

Generals As Statesmen

A collection of biographies of brilliant military leaders who tried their hand at statesmanship with less success.

Josef E. Gellerman **$2.95**

The Battle of France, 1940

How German panzer divisions and dive-bombers defeated the antiquated French army on the Meuse. With 10 full-page maps.

Col. A. Goutard **$4.00**

PLEASE KEEP US INFORMED OF YOUR CORRECT ADDRESS

ORDER FORM BOOKS BINDERS - *Armor*
1757 K Street, N.W., Washington 6, D. C.

Please send me the following:

_____

_____

_____

_____

_____

_____

NAME (Please Print)

ADDRESS (Street or Box Number)

CITY (Town or APO)

STATE

☐ I enclose $.....
☐ Bill me. (Members only.)
☐ Bill unit fund.

The Military Legacy of the Civil War

By Jay Luvaas

"We have looked at the Civil War through everything except a foreign soldier's binoculars," writes Jay Luvaas, "and through those binoculars the view is different. We may know a great deal about Gettysburg, but we have not yet watched the battle beside the Prussian major Justus Scheibert or followed a French military team through the Wilderness."

Here is a careful account of the European military observers, primarily Prussian, British and French, who watched the Blue and Gray maneuver, of what these observers wrote when they returned to their own armies, of how the Civil War came to be regarded as the forerunner of World War I by European tacticians, and of the lessons from the Civil War applied to World War II tank combat.

The European point of view on such generals as Sherman, admired in Europe for his mastery of logistics, and on firepower, surprise attacks and cavalry tactics increases our understanding of the military significance of the war. The author's thorough but unobtrusive annotation will prove permanently useful to Civil War enthusiasts and scholars.

$5.95

Meade of Gettysburg

By Freeman Cleaves

General George Gordon Meade is best known to history as the commander of the victorious Army of the Potomac at Gettysburg, the greatest battle of the Civil War. In his own lifetime meager credit was allotted him for his achievement at Gettysburg, for his long pursuit of General Lee into Virginia, and for the furious marches his men were forced into both before and after Gettysburg, until, finally, in the vicinity Appomattox Courthouse, he again held the upper hand.

The fourth-ranking officer in the Federal Army following the Civil War, Meade was one of that small corps of professional soldiers who ably conducted campaigns both North and South. Plain-spoken, restless and impatient, he was a familiar figure close to the front in many major Civil War battles, where his sound generalship won the respect of his troops and fellow officers, though Grant later, almost incomprehensibly, gave preferment to Sheridan.

Here, then, is a stimulating account of the strategies behind the important battles in which Meade distinguished himself: the Second Battle of Bull Run, Antietam, Fredericksburg, Chancellorsville, Gettysburg and the Wilderness Campaign.

$5.00

the association's magazine . . .

The function of the Association's magazine is to serve the membership and to serve it well. How? By disseminating knowledge of the military art and sciences, with special attention to mobility in ground warfare; promoting the professional improvement of the membership; and preserving and fostering the spirit, the traditions and the solidarity of Armor in the Army of the United States.

This doesn't mean for one or two issues but on a steady, continuing basis. Modern technology has brought about many changes evident in today's Army. It will continue to do so in the years ahead. Armor is an integral part of the overall Army team. As such, we must keep our members abreast of those changes which may affect Armor's role as a member of that team. To do so the Association and its magazine must continue to grow. This means that we must have a steady flow of new members into the Association.

Where are these new members to come from? The best answer is another question: Are *all* of the officers in your unit (Regular — National Guard — Reserves) members of the Association? If not, do them a favor, encourage them to join now!

They will receive the magazine devoted to the coverage of mobility in warfare. A magazine that will take the guesswork out of their military reading and provide issue by issue proof that the investment of only a few pennies a day was the best investment they ever made in support of their military career. In between issues they will receive a newsletter.

A unit cannot be a member of the Association but it can subscribe to the magazine. Does your unit subscribe? If not, get a unit subscription and keep the magazine in the dayroom where it will be available to your key noncommissioned officers. They, also, will benefit from reading . . . . . .

ARMOR *The Magazine of Mobile Warfare*

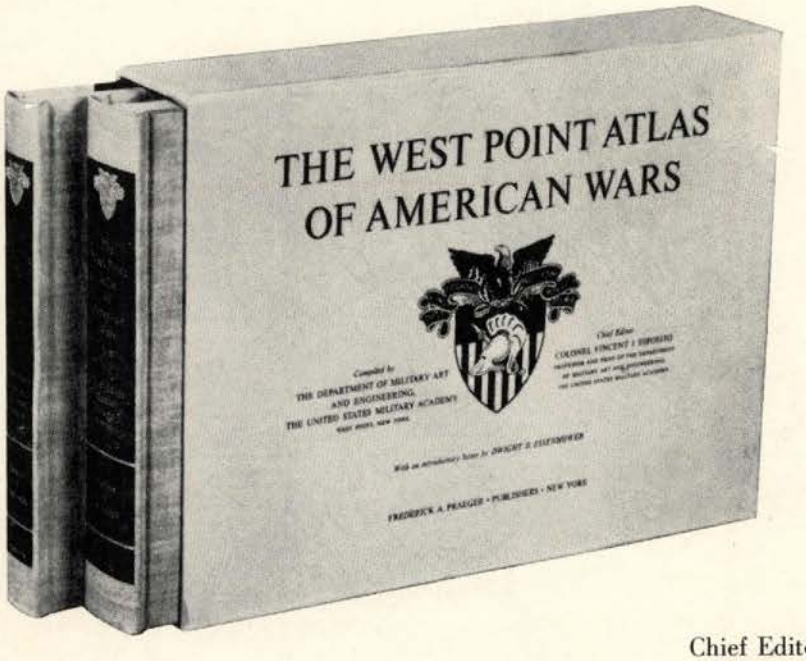
ARMOR

CARDED

NOVEMBER-DECEMBER, 1959

80 CENTS

THE WEST POINT ATLAS OF AMERICAN WARS



Format—14½ x 11

Two volumes, boxed
$47.50

Publication date
October 27

Prepublication price
(good until December 15)

$39.95

(Members—deduct an additional 10 percent)

Chief Editor,
Colonel Vincent J. Esposito,
Head of Department of Military Art and Engineering. U.S. Military Academy, West Point, N.Y.

★ An event of unique significance in American publishing

★ For the first time available to the general public

More than 400 full-page maps of battles and campaigns in three or four colors covering every war in which Americans have fought—from the Colonial skirmishes to Korea. The 250,000 words of original text, specially prepared by the West Point Department of Military Art and Engineering, tie in with dynamic map sequences to bring alive not static situations but movements, the changing tactical and strategic picture . . . history in the making. This is the book and the maps used in the basic Military History course at the United States Military Academy. It is a revolutionary project in the field of history, employing a new method of integrating maps and text . . . the first major, properly illustrated work of its kind ever available to the American public.

The United States Armor Association

(Established 1885)

President
LT. GEN. GEORGE W. READ, JR.

Honorary President
MAJ. GEN. GUY V. HENRY, RET.

Vice Presidents
MAJ. GEN. W. PAUL JOHNSON
MAJ. GEN. DONALD W. MCGOWAN, NG
COL. WILLARD WEBB, USAR

Honorary Vice Presidents
GEN. JACOB L. DEVERS, RET.
GEN. WILLISTON B. PALMER
GEN. WILLARD G. WYMAN, RET.
LT. GEN. EDWARD H. BROOKS, RET.
LT. GEN. CLOVIS E. BYERS, RET.
LT. GEN. JOHN H. COLLIER, RET.
LT. GEN. WILLIS D. CRITTENBERGER, RET.
LT. GEN. HOBART R. GAY, RET.
LT. GEN. ALVAN C. GILLEM, JR., RET.
LT. GEN. GEOFFREY KEYES, RET.
MAJ. GEN. ERNEST N. HARMON, RET.
MAJ. GEN. JOHN C. MACDONALD, RET.
BRIG. GEN. SIDNEY R. HINDS, RET.
BRIG. GEN. WILLARD A. HOLBROOK, RET.
BRIG. GEN. HENRY CABOT LODGE, USAR
BRIG. GEN. PAUL M. ROBINETT, RET.
BRIG. GEN. HARRY H. SEMMES, RET.

Secretary-Treasurer
LT. COL. WILLIAM H. ZIERDT, JR.

Executive Council
GENERAL BRUCE C. CLARKE
LT. GEN. THOMAS L. HARROLD
LT. GEN. ARTHUR TRUDEAU
MAJ. GEN. FREDERIC J. BROWN
MAJ. GEN. HOMER O. EATON, NG
MAJ. GEN. ROBERT E. FRANKLAND, NG
MAJ. GEN. LOUIS V. HIGHTOWER
MAJ. GEN. CLAYTON P. KERR, NG
MAJ. GEN. HARRY W. JOHNSON
MAJ. GEN. SAMUEL L. MYERS
MAJ. GEN. ALMERIN C. O'HARA, NG
MAJ. GEN. JAMES B. QUILL
MAJ. GEN. MAXWELL C. SNYDER, NG
MAJ. GEN. JOHN K. WATERS
MAJ. GEN. EARLE G. WHEELER
MAJ. GEN. EDWARD O. WOLF, NG
BRIG. GEN. CHARLES G. DODGE
BRIG. GEN. JAMES I. KING
BRIG. GEN. HAL C. PATTISON
BRIG. GEN. FRANK HENRY
BRIG. GEN. W. H. S. WRIGHT
COL. BOYD BRANSON
COL. LAWRENCE V. GREENE
COL. DELK ODEN

ARMOR

The Magazine of Mobile Warfare

Continuation of THE CAVALRY JOURNAL

EDITOR
Lt. Col. William H. Zierdt, Jr.

BUSINESS MANAGER
M Sgt J. William Joseph

ASSISTANT TO THE EDITOR
Sfc Michael E. Kekker

CIRCULATION MANAGER
M Sgt William Coley, Jr.

Volume LXVIII NOVEMBER-DECEMBER, 1959 No. 6

CONTENTS

LETTERS TO THE EDITOR 2

SWEDISH ARMOR 4
By Lieutenant Colonel Mirco P. G. Rolf

THE ANTITANK GUIDED MISSILE vs. ARMOR 9
By Captain Paul M. Crosby

EDITORIAL 14

SOVIET TANK SUPERIORITY? 16
By Captain John D. Henderson and Captain Ernest Kassner

POWERFUL, HIGHLY MOBILE TANK STILL ARMY OBJECTIVE 19
By Mark S. Watson

ALLY IN GRAY 20
By Lieutenant Colonel John W. Hopkins, Jr.

TANK ARMAMENT 25
By Richard M. Ogorkiewicz

SELF-PROPELLED ARTILLERY DEVELOPMENT 30

SEEN AT THE 41ST MEETING OF THE AMERICAN ORDNANCE ASSOCIATION: 32
A Pictorial Feature

INDIVIDUAL, SQUAD, SECTION AND PLATOON TESTING 34
By Captain John C. Faith

A STANDARD EMERGENCY TASK FORCE 39
By Colonel John K. Boles, Jr. and Lieutenant Colonel Jacob R. Degenhardt

THE MORTAR AND NAVIGATION 42
By Second Lieutenant James W. Owen

TANKS? 44
By Major W. C. Barrett

TRANSPORTATION THRIFT THROUGH CENTRAL DISPATCH 47
By Major Robert L. Jones, Jr.

A NEW TANK CREW TRAINER 48

NEWS NOTES 50

FROM THESE PAGES 52

HOW WOULD YOU DO IT? 53
A U. S. Army Armor School Presentation

THE BOOK SECTION 58

COMMAND DECISIONS 58
Reviewed by Walter Millis

INDEX TO VOLUME LXVIII, 1959 62

ARMOR magazine is published under the auspices of the United States Armor Association, and is not an official publication. Contributions appearing herein do not necessarily reflect official thought or indorsement. Articles appearing in this publication represent the personal views of the author and are published to stimulate interest in, provoke thought on, and provide an open forum for decorous discussion of military affairs.

Publication and editorial offices: 1757 K Street, N.W., Washington 6, D. C. Copyright 1959, by the United States Armor Association. Second-class postage paid at Washington, D. C. and at Additional Entry. Terms: Domestic subscriptions, including APO's, $4.75—one year and $8.00—two years. Foreign, including Canada & Pan America, $5.50—one year and $10.00—two years.

LETTERS TO THE EDITOR

Re Pictorial History of Armor

Dear Sir:

Lieutenant Colonel Rigg's article, "Pictorial History of Armor," in the September-October issue was read with interest. His use of the historical data in *TAHK* is unfortunate, however. Errors appear in items 42, 45, 54, 55, 57, 64, 68, 69, 100 and 101. In addition, the illustrations of items 48 and 92, as well as the caption of item 110, are misleading.

Specific Corrections

1. Item 42: U. S. six ton, Model 1917.
2. Item 45: weight: 165.3 tons.
3. Item 51: Armstrongs should be spelled with two s's (Vickers, Armstrongs, Ltd.).
4. Item 54: Vickers Carden Loyd Patrol Tank, first type (leaf springs), 1932.
5. Item 55: Independent Tank, Mark II; weight: 33.6 tons (1928).
6. Item 57: Vickers Armstrongs Six ton, Alternative A (actual weight: 8.1 tons).
7. Item 64: 81½ tons.
8. Item 68: U. S. Medium A, M-1921.
9. Item 69: U. S. Light Tank T1 (1927). This is not the T1E2 (1929).
10. Item 92: Shown is the T34-85. This adoption of the 85mm gun, as illustrated, occurred later than 1940.
11. Item 100: Pavesi, M1925.
12. Item 101: Ansaldo (1930).
13. Tanks of item 105 and 106 are of the same type (the Carden Loyd Light Amphibious Tank).
14. Item 110: Polish Smoke Tank (not used for poison gases).

To all serious students of early tank history, the following reference material is recommended: 1. Jones, Rarey, and Icks, *The Fighting Tanks Since 1916,* Washington, D. C.: The National Service Publishing Co., 1933. *A must!* 2. Heigl, *Taschenbuch der Tanks, Ausgabe 1930,* Munich: Lehmann. 3. the *Royal Tank Corps Journal.*

Despite its obvious errors, the Russian text *TAHK* is informative, if studied with sufficient incredulity.

CAPTAIN JAMES S. BRETT
Department of Social Sciences
U. S. Military Academy
West Point, N. Y.

● *It is possible that there are some variances in weights and other specifics between various sources. Also some of the corrections add more detail to the cryptic titles presented by the author in the original text. The captions were not intended to be encyclopaedic but rather short and to the point as a means of identification. Several Association members phoned this office and stated that certain prominent vehicles were omitted. We would appreciate receiving any written comments along these lines in order to expand this pictorial history.* ED.

Army Chess Players?

Dear Sir:

Mr. Thomas Emery of New York City, a former member of the U. S. Marine Corps and an outstanding international chess player, has made a grant to the American Chess Foundation to be used for prize awards to chess players in the United States Armed Forces who have distinguished themselves in the game. The object of these awards is to encourage the playing of chess in the Armed Forces as a stimulating yet recreational program; to help in discovering superior leadership material; and, since chess is properly regarded as of a high intellectual and cultural value, to enhance the prestige of our Armed Forces nationally and internationally.

This chess program will culminate in an Annual Tournament held, beginning with 1960, in Washington, D. C., during Armed Forces Week. Twelve of the outstanding players from the Armed Forces will participate in a planned round-robin tournament of two games per day lasting one week. Prizes are to be as follows:

First Prize	$1,000
Second Prize	500
Third Prize	250
Fourth Prize	150

Each of the other participants in the final tournament will receive a $100 U. S. Savings Bond, Series "E." A trophy will also be available for the Service from which the first prize winner comes.

Active duty personnel in the Army, Navy, Air Force, Marine Corps, Coast Guard, the reserve components, the National Guard and all service academies personnel are eligible for these awards.

Additional information may be obtained from your Special Service Officer and USO personnel located in the area. For further information please contact the undersigned.

COLONEL JOHN D. MATHESON
ACF-USCF Joint Committee
for Armed Forces Chess
1512 North Highland Street
Arlington 1, Virginia

The July-August Cover

Dear Sir:

When I first saw the painting by Mr. Conn at the brick mess at Fort Knox I noticed that the M48A2 tanks illustrated have only three support rollers.

Being a Reserve officer, *ARMOR* has enabled me to be in touch with the latest developments in our combat branch and a great help in passing the word along to the men in our Reserve component.

2D LT. WALLACE H. VAN DYKE
Co. D, 5th Medium Tank Battalion
United States Army Reserve
Baltimore, Maryland

The SOMUA Tank

Dear Sir:

I should like to know if any of your readers can furnish me with some vital

ARMOR is published bimonthly by the United States Armor Association.

Copyright: ARMOR is copyrighted 1959 by the United States Armor Association.

Reprint Rights: All Rights Reserved.

Advertising: ARMOR is the professional magazine of the United States Armor Association; a nonprofit, noncommercial educational publication. We DO NOT accept paid advertising. Such advertising as does appear in ARMOR is carefully selected by the Editor and concerns only those items which may be considered an adjunct to a professional career.

Manuscripts: All content of Armor is contributed without pay by those interested in furthering the professional qualification of members of the Armed Services. All manuscripts should be addressed to the Editorial Office, 1757 K Street, N.W., Washington 6, D. C.

Change of Address: All changes of address should be sent to the Editorial Office in time to arrive at least two weeks in advance of publication date of each issue, which is the 25th day of the even months of the year: *i.e.*, Dec 25 for Jan-Feb issue, Feb 25 for the Mar-Apr issue, etc.

Rates: See bottom of contents page.

statistics and illustrations (side, front and back views) of a particular French tank of World War II. I understand it uses a formidable weapon but find very little information obtainable. The tank I speak of is the French Medium Tank, SOMUA.

Any information, especially illustrations, will be appreciated.

T/Sgt. George M. Vulgaris
319 Bruce Road
Lockport, Illinois

Antitank Guided Missiles

Dear Sir:

No less than 12 antitank guided missiles have now been announced in the western world. And it seems reasonable to suppose that the Communist bloc has produced at least one of these most dangerous tank killers, which are made even more potent by their exceptional ease of concealment and lack of give-away flash.

That we can kill more enemy tanks is good news. But what can we do to prevent a massacre of our own tracked vehicles? Let's first take a look at the capabilities of these weapons. Two facts at once strike us. *First*, the warhead is about ¼ to ⅓ of the weight of the missile. Therefore, if the weapon is to be handled by infantry, like the classic SS10, there is a definite limit to its warhead size and hence its penetration. The larger missiles, such as the British MALKARA, with its rumored 50 pound warhead, are designed to be launched from vehicles. These are less of a menace, as their launcher vehicles are just as susceptible to shot as any other combat vehicle. The second point is this. The missile is guided along the line of sight between the controller and target. It can then only hit a vertical surface.

The penetration of the SS10's warhead is something like 13 inches. Can we then armor at least the frontal vertical surfaces to withstand this? It is possible but it will greatly increase tank weight and reduce mobility. There is, however, another way. The shaped-charge warhead employed loses much of its power when detonated at a distance. The Germans employed thin sheets of armor plate held about 6" from the main armor for defense against the U. S. 2.36" bazooka and the British P.I.-A.T. in late World War II. These, where fitted, were moderately effective. I suggest that this method could be applied to the present M48 as follows without increasing overall dimensions.

1. A sheet of armor steel ½" thick x 1' 6" high x 12' wide. This would be mounted vertically on the forward edge of the fenders, with its own top edge level with the tank deck. It would be carried on brackets, and the head lamps would be moved forward onto it.
2. Two sheets, each ½" thick x 3' high x 7' 6" long. These would curve to follow the lines of the turret. They would be carried on brackets at a distance of 1' 6" from the main armor. The forward edges would be in line with the edge of the gun shield and about 1' in front.

These plates would not be subject to damage by machine gun fire or shell splinters but would, of course, be easily penetrated by tank guns. If the combination of ½" armor, 18" air space, and the normal heavy armor is not sufficient, then we just move the plates further apart. This would add less than ¾ of a ton to the tank's weight!

A future medium tank might make use of spaced plating to provide the buoyancy to make it amphibious, at least on inland waterways.

The use of infra-red homing missiles poses its own problems in tank defense. Should we try to shield it out altogether, or concentrate it at one point which we then especially protect? How about trying to make the missile fly down a special 6' disposable red-hot stove-pipe?

Philip Barker
99 Brentford Road
Kings Heath, Birmingham 16,
England

THE COVER

This U. S. Army photograph was taken at the 41st meeting of the American Ordnance Association held at Aberdeen Proving Ground, Maryland on the 8th of October. Here the M88 recovery vehicle is lifting the M113 Armored Personnel Carrier. For more pictures from this demonstration see pages 32-33.

Clash of Cavalry

The Battle of Brandy Station

BY

FAIRFAX DOWNEY

The story of the greatest cavalry engagement of the Civil War, and of the cavalry as a whole, told by the author of *Sound of Guns* and *The Guns of Gettysburg*.

$4.95

◆ ◆ ◆ ◆

Stalingrad:

Point of Return

BY

RONALD SETH

A thorough and careful account of the siege of Stalingrad, the battle that ended the German advance and began Russia's triumphant march to Berlin.

$4.50

Swedish Armor

By LIEUTENANT COLONEL MIRCO P. G. ROLF

THE Armored Troops of Sweden, like those of other countries, have not been in existence for a very long time. The first unit, a company with old German tanks, was organized in 1922 as a part of the Royal Svea Lifeguards, the finest and most high-ranking infantry regiment in the Swedish Army. According to the Defense Act of 1925, a tank battalion was to be organized in the same regiment. Later on, this battalion was transferred to the Royal Goeta Lifeguards. During the 30's extensive research was carried on in this regiment using homogeneous tank units and motorized antitank units meant for support of standard infantry.

The Defense Act of 1936 disbanded the Goeta Lifeguards. The Armored troops, however, were enlarged by organizing an armored battalion within each of two infantry units, the Royal Skaraborg Regiment and the Royal Soedermanland Regiment. These battalions were ready in the beginning of 1940. Then the term *Tank* was changed to *Armor* to give a more adequate expression of the new task of the Swedish Armored Forces. Later on, the Swedish Army began to create a real armored infantry by first organizing special escort units for the tank units. In order

to avoid misunderstanding it should be said that the armored units mentioned earlier were mainly training depots. Organization for war was on a larger scale. At the end of 1940, for example, each of those battalions could mobilize one tank battalion and several motorized antitank companies.

This, however, was only the beginning. A big step was taken through the Defense Act of 1942. The Swedish armored forces were separated from the infantry and expanded to form an independent branch of the Army with their own representative in the Army staff, the Inspector General of the Armored Troops. At this time the previously mentioned infantry regiments were reorganized to form armored regiments. One cavalry regiment was reorganized as the Royal Skaanska Armored Regiment. The Royal Goeta Lifeguards was reactivated as the Royal Goeta Armored Lifeguards. An armored company was organized on Gotland, the largest island in the Baltic Sea. In addition to this reorganization, the tasks of Armor were extended; in time of war they had to organize armored brigades. These previously mentioned regiments, organized as peacetime training depots, trained homogeneous tank units, armored infantry units, and antitank units. Also, an Armor School was organized.

In 1949, as a result of wartime experiences, the armor organization was increased and the number of armored brigades was doubled. Three standard infantry regiments were reorganized as armored infantry regiments. The armored infantry training was transferred from the armored regiments to the armored infantry regiments.

As a result of the widened strategic importance of the Scandinavian Arctic Region, the Royal Norrbotten Armored Battalion was organized in 1957. In this way the Swedish Armored Forces got a winter training center. In the same year the training of antitank missile units began as an enlargement of the war organization.

The Swedish armored and armored infantry regiments are chiefly former standard infantry units. Only one cavalry regiment has been transformed into an armored regiment. Most of these regiments are old units with a glorious history. Some of them fought with honor as early as in the Thirty Years' War in 1618-1648. Victory names are embroidered on their colors and many of these names are well known in military history.

LIEUTENANT COLONEL MIRCO P. G. ROLF, a 1935 Swedish MA graduate, was commissioned in the Infantry. Transferring to Armor in 1937 he served in an armored regiment until 1942. Next he attended the Swedish C&GSC and transferred to the General Staff Corps in 1947. Next he served in an armored infantry regiment. He returned to the GSC in 1954. In 1956 he visited the 2d and 3d Armored Divisions in Germany.

A characteristic feature of the present peacetime units in the Swedish Armored Forces is the close connection of the regiment with its home region, founded on many hundred years of tradition. This tradition is maintained by local recruiting of enlisted men and prospective officers. This applies to personnel on active duty, reserve and conscripts. By this system the Swedish Army achieves another advantage of great importance: very short times for mobilization of the reserve units. The ties with the home region are also maintained by annual celebrations in each regiment, called "Regiment's Day." On these occasions, relatives of the officers and men are invited to military exhibitions and various sorts of realistic exercises. They also have an opportunity to become familiar with the life of their sons, brothers and husbands in the regiment. Each regiment has a "comrade association" comprising both personnel on active duty and personnel who have left the regiment. There are frequent exchanges between the personnel of the regiment and the people of the area.

According to present planning the Armored Forces will gain a greater importance within the Swedish Army, and consequently be modernized and enlarged.

Materiel

The tank battalions in the troop basis of 1940 had the Swedish built tank M37[1], a 4,5 ton[2] high-speed tank of Czechoslovakian design, armed with two machine guns as main equipment. Further there was a comparatively small number of the tank M38 or M39 (Swedish built 10 ton tanks with a 37mm gun and two machine guns). The Swedish armored brigades of 1943 consisted chiefly of the tank M40 or the 11 ton tank M41, of Czechoslovakian design, both with the same armament as the tank M38. They had also a lot of the Swedish built 22 ton tank M42 with a 75mm gun and four machine guns. The tank M42 and also the tanks M38, M39 and M40 were developed by Landsverk, Sweden. In addition, the armored brigade had a number of 23 ton self-propelled 75mm antitank guns M43. For the transportation of armored infantry, the armored truck M42, a cross-country 4 x 4 vehicle, was introduced into the organization in 1943. At the same time the armored artillery in the brigade got a prime mover for their howitzers, the half-track M43. A self-propelled 40mm antiaircraft automatic gun of the world-renowned Bofors design, joined the family in 1944.

After the war years were to pass, before money could be appropriated for the renewal of the equipment of the Swedish Armored Forces. During these years the Swedish Army tried to evaluate the lessons of the war. Principles were formulated which could be used for the renewal of tanks and other equipment, as soon as the need and the opportunity arose.

The Swedish Army Headquarters had to take into consideration the special conditions of Sweden's terrain and climate. They had to study the capabilities abroad. Predominantly open terrain is to be found in vital operation areas, especially in southern Sweden, whereas partially open terrain will be found in the northern part of the country. So, it is necessary to have tanks, which are comparable to what an enemy can launch against us. It should be mentioned that cross-country operations and maneuverability of tank forces sometimes may be far better in the winter than in the summer, especially in the northern part of the country. Lakes, streams and swampy ground freeze, permitting cross-country operations.

With the Korean War, a reinforcement of the Armed Forces appeared as a necessity. New tanks had to be rapidly introduced. In this urgent situation the only possible solution was to get them from abroad. The

[1] M37 was standardized in 1937.
[2] A metric ton equals 1.1 short tons.

British medium Centurion tank was chosen in 1952. It is now the standard tank in most of the armored brigades.

However, all Swedish terrain is not suited for medium tanks, because of numerous streams, narrow and poor roads, and bridges with low capacity. Therefore, it was necessary to obtain a light cross-country weapon capable of giving the Swedish infantry sufficient fire support when operating in the middle and the northern part of Sweden, where terrain with short combat ranges predominates. Consequently, the Infantry Assault Gun, a nine-tonner with a 105mm gun, was introduced in the beginning of the 50's. It is lightly armored and has no turret. Its most vital characteristic is its low ground pressure, being slightly lighter per square inch than that of the infantry soldier. It has splendid cross-country ability.

To provide the infantry with further fire support, the old 22-ton M42 tank has been rebuilt in a radical way. A new 75mm gun with a much longer tube and a far better armor piercing ability has been substituted for the old piece. The power of the engine has been considerably increased and the tracks have been made wider. The rebuilt tank is named *Tank 74*.

The international tendency toward lighter tanks is followed with great interest in Sweden. This is of particular importance because of Swedish terrain conditions. The probable fire superiority of an enemy makes it necessary to have tanks which can fight in darkness. The tanks must be capable of enduring the hard winter conditions. Fording or swimming ability is also important.

At present, tests with armored personnel carriers are carried out in order to give the armored infantry a transport and combat vehicle, which can accompany the tanks and respond to the conditions of atomic warfare. The intention is to rebuild older light tanks to APC's as a beginning.

Organization

It has already been mentioned that the most powerful and qualified tanks are grouped into operational units, called armored brigades. In addition there are infantry assault tanks incorporated into the infantry brigades. As a reinforcing element there are independent tank units, called corps tank battalions.

The Centurion tank in Swedish terrain.

In the first Swedish armored brigades of 1943 the tanks were the predominating element. There were two tank battalions and one infantry battalion. The organization corresponded to the combat command of an American armored division.

The armored brigades were reorganized in 1949. The most important innovation was the enlargement of the armored infantry into two battalions, while the tank strength decreased to one battalion. Further, a heavy mortar company was added to the brigade. The armored infantry had become the dominating element in the brigade. Since then the brigade has corresponded more to a mechanized unit than to an armored brigade.

A majority of the combat personnel in the former fully motorized armored infantry battalion were supplied with bicycles. These troops were towed behind trucks or other cross-country vehicles (many of them American surplus matériel) using long ropes. In this way it was possible to make long marches even under bad weather and road conditions. In Sweden this manner of transportais called "cycle-towing." In daylight

Swedish Infantry Assault Gun 103.

Swedish Tank 74.

the armored infantry units could do 20 MPH and in darkness 10 mph. When the towing vehicles could not go further because of terrain difficulties, the infantry continued on their bicycles.

The Swedish armored brigades have just been reorganized again. The firepower has been considerably increased by adding more howitzers and more heavy mortars. The antitank gun (SP) unit has been replaced by a tank unit. Instead of the former homogeneous tank and armored infantry battalions, the brigade comprises three mixed battalions, called armored battalions and comprised of tank and armored infantry companies. A basic idea behind this task force organization is to avoid time consuming attach and detach procedures. This seems to be important when repelling a coastal or an airborne invasion, especially in an atomic war. Another idea is utilization of the training period for maximum teamwork between the tank and the armored infantry units.

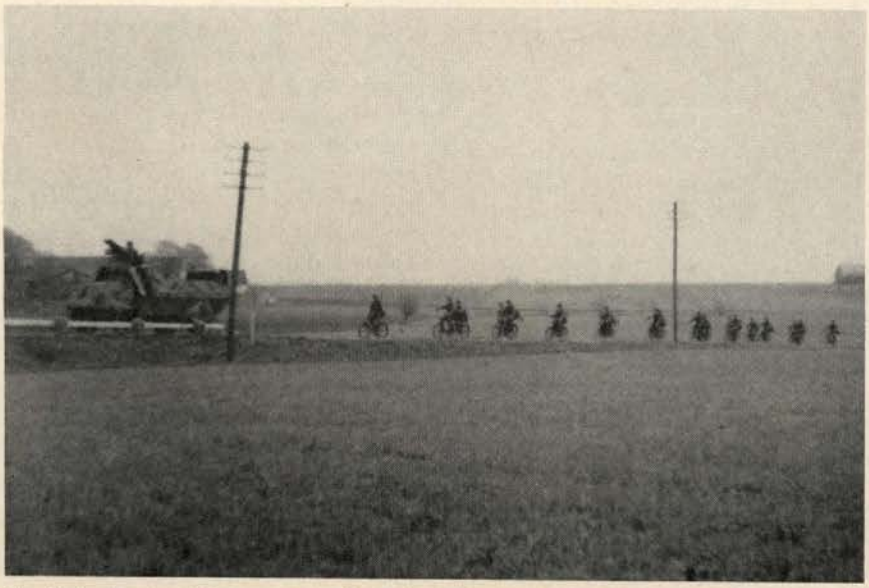
Since World War II due to economic reasons, the pool of cross-country vehicles has not been modernized to such an extent as would be desirable. Instead of the unarmored cross-country cars, wheel tractors have been put into organic transport of the armored brigade. Additional tractors of this type can be easily secured in case of mobilization. Accordingly, the bulk of the armored brigade personnel can be towed on bicycles or cycle by themselves. The main part of the bicycling units of the armored battalions can be moved fully-motorized in pressing situations.

One characteristic of the Swedish organization is that the units are comparatively small. An armored infantry company counts about 170 men, a rifle platoon about 35 and a rifle squad seven men. The headquarters and the headquarters company is generally smaller than is common in the American armored organization. The number of vehicles in the new Swedish armored battalion is about 100. In this way, the units are rather flexible and easy to control, which is an advantage in the Swedish terrain with its comparatively small spaces for maneuvering.

Besides the antiaircraft unit organic to the armored brigade many vehicles are armed with antiaircraft machine guns. When attacking in open ground further antiaircraft units will be attached so as to give antiaircraft protection for the whole concerned area.

The infantry assault gun unit integral with the infantry brigade is smaller than the tank companies of the armored brigade. The independent corps tank companies have chiefly the same organization as those tank companies integrated with the armored brigades.

According to current plans the armored forces will be enlarged. The number of tanks in the armored brigade is expected to increase. In addition, the armored infantry units will probably be equipped with modern armored personnel carriers. The net gain will be a considerably higher combat efficiency.



Swedish Armored Infantry with their bicycles towed by an armored vehicle.

Tactics

The development of Swedish armor tactics is to a certain extent a reflection of the evolution abroad. Up to 1942, the main task was the supporting of standard infantry units. The German victories in the West were reflected in tactics used by Swedish independent armored units,

of which the armor organization of 1943 was an expression. During the last years of the war, and also after the war, a more cautious type of tactics dominated. This period may be characterized as an artillery and infantry period, with longer time to prepare for attacks. During the 50's more flexible and mobile tactics have been gaining ground. The tanks will be the predominating element in the combat of armored units and they will also play an important role in the combat of the ordinary infantry.

By following the evolution abroad, making comparisons, choosing ideas adaptable for Swedish conditions, and melting them together with Swedish ideas and experiences the Swedish Army Staff seeks to develop national armor tactics, well suited to Swedish strategical requirements. Special attention is given to the activity of armored units in fending off a coastal invasion and to the evolution of night battle techniques. Since the armor battalion in the vicinity of the Polar Circle has been established the Swedish Army has better possibilities to study armored warfare during winter conditions. Assuming hostile air superiority the units are thoroughly trained to disperse and camouflage themselves. The conversion and adaptation to atomic warfare has in respect to dispersion and camouflage been prepared in Sweden. Concerning battle control and direction, a basic feature of the Swedish military training is to give the subordinate commander a mission and to leave the execution and the details to him. Mission type orders predominate. This tradition will facilitate the conversion to more mobile tactics. It would be presumptuous to say that these tactics up to now have been given any final shape. They are under evolution. As abroad, an intense work is going on to solve the combat problems of the atomic age. Numerous impulses have been received from the United States Army, and they have been of great value to the Swedish Army.

Training

The Swedish Army consists mainly of conscripts. As the conscripts have only 10 months for their basic individual and unit training, followed by three repetitive one month training periods, special attention must be paid to the training. Conscript officers and noncommissioned officers get a more thorough training: 12 months and six months respectively, in excess of what is required from all conscripts, plus three repetitive training periods of 40 days each. Reserve officers get the same basic training as conscript officers, plus a considerable number of additional training periods, a total of 50 days per every three-year period.

The training is accomplished in a regimental training system. The disadvantage of the training is to some extent diminished by inducting each year the main body of the age group simultaneously. This system makes it possible to draw up a logical, gradually stepped-up training program without disturbance by continuous induction of new conscripts and without neglecting the training of the active personnel. By entering the service in the early summer the untrained recruits get the finest possible training weather. As a rule conscripts are not employed in non-military labor service, as store service, etc. As much time as possible is used for real training. Special importance is attached to furnishing good training aids and facilities at every regiment.

All of the photographs used as illustrations with this article were supplied by the author.

Besides training grounds with possibilities for combat practice firing with small arms and mortars in the neighborhood of the barracks, there are some armor combat practice firing areas where it is possible to conduct assault combat training, including joint exercises with tanks, armored infantry and artillery units up to company and battalion level. The exercises will often be carried out with live ammunition. In order to save civilian "ground" the firing areas are generally situated along the coast.

Neighboring armor and armored infantry regiments are combined to form a training team. After the basic training is finished, they have several combined training periods together. During the last months of the first service each team will organize a joint training battalion, generally an armored battalion. Special attention is given to night operations and combat practice firing with live ammunition. Such exercises will be carried out in simulated tactical situations. Attention is also given to winter training.

During the first service period, the training will be conducted up to the battalion level. During the repetitive training periods the battalions will be integrated into a brigade. When the soldiers are called up for repetitive training, they join directly their own units with the comrades together with whom they will fight in case of war. Mobilization exercises are carried out periodically in order to develop a system of alert dispersal in the event of an atomic attack. This gives a realistic background to the repetitive training periods.

The training is aided by the technical interest and knowledge common in Sweden. Because of a widespread use of motor vehicles in the country, the soldier's technical knowledge of motors is good already when he starts his military training. (Sweden has the largest number of vehicles per capita in Europe.) Also the previous knowledge of small arms shooting and of orientation with map and compass are advantages in the training work. These last two activities belong to widespread civilian athletics in this country.

Some of the facts just related may appear small and trifling in comparison with the huge resources of such a large and war experienced nation as the United States. Sweden endeavors however—without financial aid from abroad—to maintain and develop a useful instrument of war suitable to its conditions. The Swedish people hope that their military forces will be an effective medium in preserving their peace. In case of war, the Swedes are sure that the armed forces will do their best to defend the nation's freedom and integrity. The geographical conditions in Sweden will permit a main effort of Armor in decisive areas, for example Skaane in the south of Sweden. There the Swedish armored forces will certainly have a role to play in gaining this aim.

By CAPTAIN PAUL M. CROSBY

The Antitank Guided Missile vs. Armor

THE growth of rocket-propelled weapons since the end of World War II has been so spectacular that it has forced a revision of tactical and strategical ideas the world over. The possibilities created by the combination of this method of propulsion with the nuclear warhead have led the pessimists to predict the end of the soldier, the airplane, the warship and the tank —in short, to proclaim the overthrow of nearly every conventional tool of war.

The Russians, who emerged from the war as the world's strongest land power, have advanced in the field of missile warfare. They have also accomplished a major reorganization and reequipping of their army in recent years, converting an infantry-heavy force of 175 divisions to one which is more than one-third "tank" or "mechanized."

The tank strength of the Soviet divisions stationed in East Germany, backed up by other divisions in the USSR, is the major threat to the NATO forces in Western Europe and the prime reason for the development of an effective antitank weapons system. A full strength Soviet rifle division has 77 tanks of the T54 type, mounting 100mm guns. A full strength tank division has 377 of these modern and powerful tanks.

From time to time we hear that the gun has licked the tank, that the most deadly foe of the infantry is doomed, and that the tank will be driven from the battlefield. Usually, these assurances come from those who have the most to fear from Soviet Armor and who would be happy to have these assertions confirmed. The fact remains that "the main features of Soviet tanks are the high degree of armor protection which, when combined with the sloping surfaces of the turret and glacis plate, achieves a good compromise between armor and mobility."[1]

We, in Armor, maintain that the "best defense against a tank is another tank" and that our tank weapons must be improved as rapidly as our technology permits, to make them lighter, to give them greater effective range, and to increase their deadliness. The adoption of the 105mm gun for the M60 tank is an indication of the persistent striving for something better.

With the appearance of the first generation of the antitank guided missile, further improvement in tank armament may be possible, and the special requirements of Infantry and Artillery for antitank protection may be solved as well. Claims made for these missiles are much the same as those made, in their day, for other antitank weapons such as conventional guns, grenades, rocket launchers and recoilless rifles.

From the standpoint of terminal ballistics, there are three methods of defeating Armor: the kinetic energy projectile, shaped charge and plastic charge.

Methods of Defeating Armor

Kinetic energy projectiles include the conventional monobloc shot, armor-piercing capped, and the jacketed or composite types, all of which rely upon the striking energy of a high-velocity mass to perforate the opposing armor plate. The ability of such a projectile to destroy a target depends in large part on the relation between the amount of protection possessed by the target and the power of the missile.[2]

CAPTAIN PAUL M. CROSBY, Armor, graduated from the University of California in 1948. Integrated in RA in 1950 he served three years in the 41st Armored Infantry in Germany. Returning Stateside he is now a tank gunnery instructor at the U. S. Army Armor School and project officer for troop test of the SS10 antitank guided missile.

Contributing to the difficulties facing the attacker are improvements in armor manufacture, addition of skirting plates, increases in the obliquity of protective surfaces and the use of spaced and composite armors. Each of the kinetic energy rounds has certain advantages, but none is sufficiently versatile that we can rely on it completely. For example, the increase in striking energy attained by the hyper-velocity projectiles is partially offset by the difficulty of sensing a round that flies to 2000 yards in two seconds or less.

High explosive antitank (HEAT) projectiles employ the principle of the shaped charge (Munroe effect). The thickness of armor that can be perforated by this method is independent of the striking velocity of the missile. The armor is subjected to very high pressures which produce stresses beyond the yield strength of the plate; however, the rotation caused by rifling in guns may reduce the performance of the charge 30 to 70 percent.

With high explosive plastic and high explosive squash head rounds, the target-defeating effect is achieved normally without penetration. At impact, the plastic explosive tends to spread over the target at the point of strike. Shock waves created by detonation pass through the armor and cause a spalling from the inner surface.

The Antitank Guided Missile

Fundamentally, the antitank guided missile (ATGM) is a rocket, with a shaped charge or plastic charge for target destruction, that carries a guidance system for in-flight control.

Among the first generation of antitank missiles are: *France*—SS10, SS11 and ENTAC; *England*—Vickers 891 and Orange William; *Australia*—Malkara; *Germany*—Cobra 810.

The major characteristics of the foregoing missiles are quite similar and may be grouped as follows:

Propulsion. One or more rocket motors drive the missile. The low recoil force of rockets permits use of lightweight launchers. Range of the missile can be increased by enlarging the motor.

Remote control. The gunner guides the missile's flight by radio or through wires trailing from the missile. Any change in the relative position of the missile with respect to the target can be corrected. This should yield an increased accuracy, especially against moving targets.

Warhead. With rocket propulsion, the missile can deliver a heavier charge than the gun. Low-velocity launching is also possible. The Americans tend to favor the shaped charge as an armor-defeating warhead, while the British prefer the heavier HESH or HEP types. Increases in motor size and weight follow increases in warhead weight.

A superficial analysis of the current crop of missiles in terms of the characteristics listed above would seem to show that we have attained the desirable antitank weapon, with superior range, low recoil forces, increased accuracy and ideal warhead. Before any such conclusion may be drawn, however, the weaknesses of the present systems should be known and evaluated. For purposes of simplification, the French SS10 will be described and analyzed, as it is now widely available and it is being tested in several armies. From this analysis, some conclusions may be drawn with respect to similar missiles.

The French SS10 ATGM

The SS10 is an outgrowth of German and French experimentation with small tactical missiles and it became operational in the French service in the early 1950's.

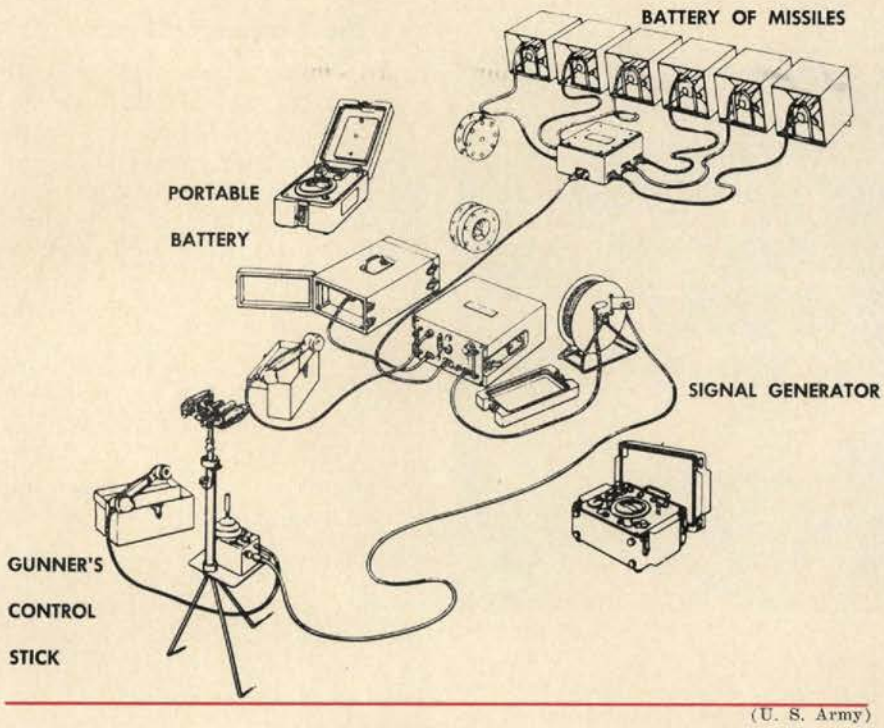
Functioning of the SS10 system is essentially electrical. A ground power supply must be provided, either from a 24-volt vehicular battery or a 26-volt nickel-cadmium power pack of French design. This power source delivers a 4-ampere direct current to a vibrator-type signal generator where it is transformed to an alternating current. These AC signals are transmitted to the missile through a pair of lacquer-insulated steel wires that unwind from bobbins inside the missile during flight. The wires are laid over obstacles, not dragged. (The wire command-link of the SS10 is very reliable and practically jamproof.) The gunner's commands are impressed upon the AC signals by a control stick. When these commands enter the missile they regulate the flow of current in the spoiler circuit.

Power for the spoilers is provided on board the missile by two 12-volt dry cells connected in series. The spoilers are located on the wings of the missile and are the control (that

Length	**33.9 inches**
Span	**29.5 inches**
Diameter	**6.4 inches**
Weight of missile	**33.0 pounds**
Weight of launcher	**15.4 pounds**
Weight of carrying case	**55.0 pounds**
Total weight	**103.4 pounds**
Maximum range	**1600/50 meters**[1]
Minimum range	**300 meters**[2]
Maximum speed	**80 meters/seconds**
Rate of fire	**3 rounds per minute**[3]

[1] Length of wire on bobbins in missile.
[2] This is the absolute minimum range. The minimum practicable range is a function of gunner skill.
[3] Initial rate, with missiles prepared for firing and the control system operable.

SS10 Characteristics



(U. S. Army)

SS10 Ground Equipment.

is, steering) surfaces. The spoiler blades, moved by electromagnets, influence the flow of air over the wings, increasing or decreasing the lift.

The SS10 has a single set of four wings, arranged in a cross-shaped pattern, permitting simultaneous change of direction in two planes for more rapid response to command.

The moving missile turns or rolls around its long axis. This roll "averages out" any minor eccentricities in the missile's horizontal center of gravity and motor thrust, and is generated by offsetting the wings from the axis of flight. Consequently, the spoilers regularly change their relationship to the missile's pitch and yaw axes and this complicates the guidance problem. For example, at maximum velocity the vertical pair of wings at one instant is controlling yaw (direction) and an instant later is controlling pitch (elevation).

The problem of the changing orientation of the control surfaces is overcome by a gyroscopic distributor. The powder-driven gyroscope rotor provides a stable reference point about which the missile revolves.[3] A four-segment commutator attached to the outer gimbals of the gyro makes it possible for the missile to "know which way is up." In other words, no matter what the position of the missile in flight, the gyro commutator divides the incoming commands into *right, left, up* and *down* and sends them to the proper spoiler pair.

When a gun is fired, the gunner's control over the projectile ceases. With the ATGM, this control can be retained because the missile carries a guidance system and a communications link. On the other hand, any transfer of the solution to the guidance problem from the launcher to the projectile increases the complexity, weight, size and cost of the missile, and creates related problems in the matters of handling, storage and pre-firing checkouts.

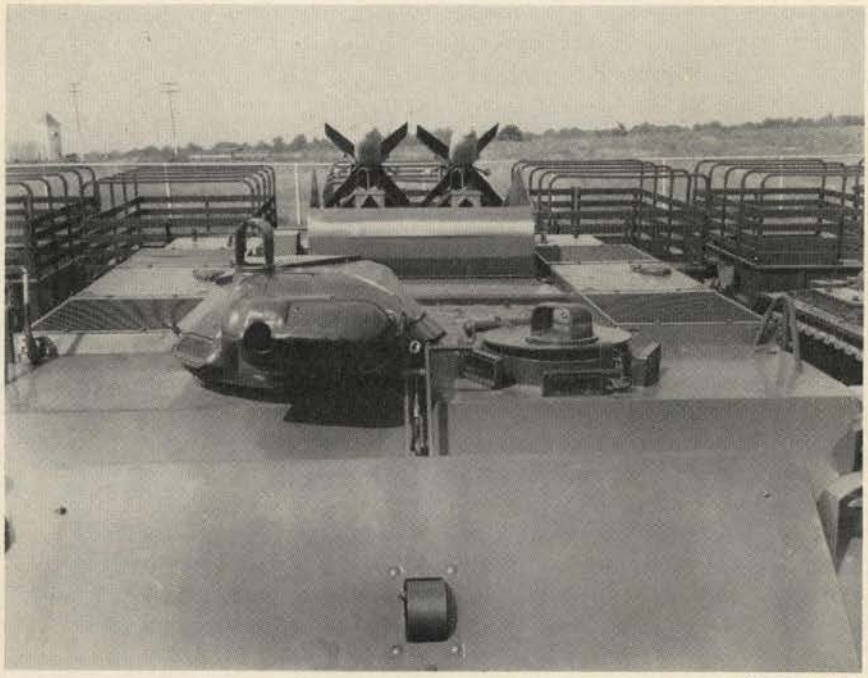
The SS10 warhead is said to be able to penetrate any known tank. (According to Army field manuals, the 3.5-inch rocket will penetrate about 11 inches and the 106-mm recoilless rifle's HEAT projectile from 16 to 20 inches.) Note, however, that *penetration* is not always equal to a *kill*. Stated another way, can we assume that we have killed a tank solely because we have knocked a hole in its armor?

Methods of Delivery

The SS10 can be fired from a variety of mounts. Its steel shipping case can be used as a launcher or (if a smaller object is dictated by the need for concealment) the missile can be taken from the case and fired

(U. S. Army)

Jeep Launcher.



(U. S. Army)

M59 Launcher.

from an integral, zero-length launcher rail. Either way, the system is vulnerable to enemy fire and very immobile. A well-trained crew needs about 15-minutes' time to set up the missiles and related cables as shown on page 11. As has been noted, this unwieldy arrangement may create tactical and logistical weaknesses.

The ¼-ton truck is a more versatile mount. This system functions in the same way as the ground-mounted version except that it carries only three missiles in a ready-to-fire position. These point to the rear when the vehicle is moving, increasing the time used to get into a firing position. This method offers little increase in mobility over the ground version because the system weight tends to decrease vehicle mobility. Likewise wheeled vehicles cannot keep pace with track-layers.

The missile can be mounted on the H13 helicopter and other light aircraft. The flying platform may be the ultimate missile carrier, but this type of mount is limited at present by the small number of missiles that can be lifted and the relative vulnerability of the carrier to ground fire.

The M59 armored personnel carrier has been tested as a launcher vehicle, using a design developed by the U. S. Army Armor Board. This method provides a floatable launcher, protection for a crew of four, and stowage for about 12 SS10 missiles partially assembled.

All of the foregoing systems have the disadvantage of requiring an increase in personnel. A platoon of eight jeep-mounted launchers, the minimum support for a battalion, would need about 50 men and 24 to 30 vehicles, depending on the number of sections. Other personnel for maintenance would be needed at the direct support ordnance unit. Under current unit space ceilings, will commanders want to sacrifice other weapons to make spaces for the ATGM?

The M48 tank may be used as a launcher, in which case, the tank crew is the missile crew. This method offers crew protection, 360° traverse, noninterference with regular armament or optics, and mobility. The disadvantages are a limited ready-to-fire capacity, missile exposure to damage from fire and vegetation, and a telltale "signature." Because of its wingspread, the SS10 is too large to pass through the tank hatches, so there would be no reserve stowage. Finally, this method of mounting would add to our antitank strength where it is least needed.

The Training of Gunners

The human gunner is the most important element in the SS10 system. The technique of fire requires him to *capture* (or gain control over) the missile, guide it laterally to the gunner-target line, then steer it downward until it is flying on the horizontal plane between the gunner's station and the target. In other words, the gunner's eyes, the missile's tracking flare and the target become three points on a line. Once established, this relationship—flare eclipsing target—is held until impact. As a result, the gunner must see the target and missile through its flight, limiting the usefulness of this type of missile under conditions of smoke or fog. The missile can be fired effectively at night, provided the target is lighted by illuminating shell (81mm mortar or larger) or by the 18-inch or 60-inch searchlights.

In some other systems, autopilots or simple computers are used to aid the gunner, but even with these additions it is the human being who remains the final judge of the correct relationship between missile and target.

The French claim that "the training of infantrymen to fire and control the SS10 is not difficult. After one month of instruction the average French draftee hits eight out of 10 moving tanks at ranges up to 1650 yards. He does not need special prior knowledge or background."[4] This statement is oversimplification. French training firings were performed under near ideal conditions, where the terrain, target and method of launching were favorable. The French themselves were selective in their choice of men for gunner training, and even they admit they do not know, as yet, the full nature of the problem. There is certainly a need for good vision and for excellent eye-and-hand coordination.

Because of the relatively high cost of such missiles the French have developed simulators to reduce training time and costs. A conservative estimate of the extra time required for gunner training is four 40-hour weeks. Will we have this additional time available in the event of mobilization? Will we be able to find the necessary

skills, or will we be competing for aptitudes needed by other services? It has been estimated that a gunner and an assistant gunner from each missile launcher in use will need school training. The average man fires 13 missiles while qualifying.

Limitations and Countermeasures

The SS10 rolls slowly in flight and there is a certain amount of unsteadiness caused by the gunner's lack of skill, muscular tension and body tremors. Taken together, the roll and the unsteadiness generate a spiraling trajectory, so that the missile flies through an imaginary tunnel of air, the diameter of which varies randomly with those particular characteristics of each missile and inversely with gunner skill. Terrain and target attitude also can influence gunnery, as when the launcher and target are separated by relatively level ground, and the target is a tank whose center of critical mass is two yards above the surface. In this case, the missile's spiraling path will skim dangerously close to the ground for half the range or more.

The combination of gunner reaction time and launch velocity causes the minimum range feature that characterizes this generation of missiles. The practicable minimum range for an expert gunner is about 450 yards, a limitation that influences the tactical value of the missile system. For example, would this weapon be of value in an airhead? A beachhead? A bridgehead? In hedgerows? In city fighting?

The faster an object flies, the less need it has for wings. The SS10 flies at about 180 MPH and requires relatively large wing surfaces. The wings are of light, metal-covered wood, a feature that limits the ability of the missile to fly through vegetation. Depending on the thickness of the trees or brush, it may deflect the missile from course, damage the control surfaces, cause premature fuze action, or ground it completely. Tactical launching positions must avoid these hazards.

The rocket backblast may disclose the launcher position, especially in areas of sandy soils, or restrict the choice of launching sites, as in urban areas. The low velocity results in longer flight time to maximum range. The rate of fire is reduced (to about three rounds per minute for the SS10), and the ability of the firing unit to engage surprise or fleeting targets is lessened. This weakness dictates employment of the SS10 in pairs for effective fire.

The Value of the ATGM for Armor

The preceding discussion has been an attempt to describe the antitank guided missile and delineate its faults. The designer of future weapons systems should have these failings in mind when planning a better armor-defeating weapon. At the same time, he should understand what armor needs to improve its existing armament; some of these desirable features are listed below:

1. Regardless of the type of warhead carried, the weapon must be lethal against the best tank the enemy has, and this terminal effectiveness is to be measured in terms of "kills" rather than a simple perforation of armor plate.

2. The accuracy of the system must show an improvement over the existing 90mm gun, and must be attainable under all conditions of visibility. Use of computers, homing devices, or any other technological improvement is desirable.

3. The range must be greater than that of the Soviet medium tank. There can be no *minimum range* characteristic.

4. A reliability exceeding 0.9 is essential. Mechanical and electrical components should be packaged so as to permit repair by substitution, after the trouble has been isolated by a simple check.

5. The system has to be small and light enough to operate from within an armored vehicle, with a reasonable number of rounds available in ready racks.

6. Operation must be simple enough to obviate the need for additional, specialized training of crews. A reduction in crew size through automatic loaders or by a combination of duties is desirable, too, as this would permit urgently needed decreases in vehicle size, weight and fuel consumption.

7. The system should be reasonably adaptable to existing troop structures. The addition or creation of specialized supporting units is undesirable.

8. Time of flight to maximum range must not prevent the crew from engaging dangerous surprise targets.

9. The missile should not be unduly sensitive to terrain or vegetation.

The present generation of antitank guided missiles has little to offer the armor commander. In its present form, the ATGM requires the training of additional specialists, the handling of large, costly and complex matériel that can be stowed in combat vehicles in only limited amounts. It will mean the addition of a relatively immobile weapons system that has an uncertain kill capability even under ideal circumstances. Until it becomes an integrated part of an armored vehicle, its vulnerability to fire will seriously impair its combat usefulness, and the size of the supporting organization will remain undesirable.

Footnotes

[1] Department of the Army Pamphlet 30-50-1, *Handbook on the Soviet Army*, 1958, p. 147.

[2] Department of Ordnance, U. S. Military Academy, *Elements of Armament Engineering*, 1956, p. 192. (Chapters 8 and 9, Part II of this edition contain a good presentation of the problem of defeating Armor.)

[3] "The Deflection of Bullets," Robert C. Dyer, Jr., *The American Rifleman*, November, 1958, pp. 45-46. (An article on the uses of the gyroscope and the causes of bullet drift.)

[4] "Death to the Tank!" Lt. Col. Albert A. Merglen, *Infantry*, July-September, 1958, p. 29.

Other articles of interest:

"Dangerous Birds," Maj. Charles M. Jones, Jr., *Armor*, March-April, 1957, pp. 11-14.

"Guided Missile Tanks," Richard M. Ogorkiewicz, *Armor*, March-April, 1957, pp. 15-17.

"Nord Ranks Near Top in Missile Volume," David A. Anderton, *Aviation Week*, April 14, 1958, pp. 33-35.

"Cobra Enters Infantry Weapons Race," (no author indicated), *Aviation Week*, June 30, 1959, p. 45.

"Antitank Missiles For Armored Infantry," John D. Webber, Norman D. DeBord, Clifford D. Rhodes and Robert W. Thams, *Armor*, September-October, 1959, pp. 65-67.

Editorial

In all phases of national defense, we read a great deal about research and its application to equipment items. In fact there has been some comment in either news form or editorial expression daily concerning missiles and other items of equipment.

However, little is heard of the field of research concerning the human being. True, from time to time we have published articles in *ARMOR* concerning phases of research and their results in various experiments by the human research units. We have published, in particular, articles concerning training the individual and tank crew as studied by the U. S. Army Human Research Unit at Fort Knox. These studies concern the soldier who is mentally and physically able to perform duty. What about the rejects?

Some nine years ago when our present Commander-in-Chief was the President of Columbia University, he instituted a study in the field of human resources to include the conservation of personnel. It is appalling to this editor to realize that during World War II, out of eighteen million people called up for induction, over five million were rejected. This means that during a time when our country was imperilled, almost 28 percent in the proper age bracket were unfit for service. Now during the cold war period, and realizing that our potential enemies far outnumber us in manpower, it would seem that we can ill afford such a situation to again confront us.

This study was conducted by a very able group of individuals. It included an administrative expert, a psychiatrist, a psychotherapist, a psychologist and personnel expert, a statistician and a psychiatric worker. The head of this group was Mr. Eli Ginsberg, Professor of Economics at Columbia University. As director of the Conservation of Human Resources Project, it is a tribute to Mr. Ginsberg that he personally wrote the three volumes with the draft materials of his collaborators to guide him. This three-volume series is titled: *The Ineffective Soldier. Lessons for Management and the Nation.* Volume I is appropriately entitled *The Lost Divisions.* In it is discussed, not the five million rejectees, but the 2.4 million men who were accepted for service and later rejected or prematurely separated for mental or emotional reasons. Another appalling figure! When one stops to realize that only 89 divisions were mustered during the war this astronomical figure, 2.4 million, represents some additional 165 combat divisions. The second volume, *Breakdown and Recovery,* is composed of some 79 brief life histories and the buildup leading to breakdown in each case. It is noteworthy here to mention that the strains and stresses of battle played but a small part in ineffectiveness. In fact three out of four men who broke did not even get overseas. The third volume, *Patterns of Performance,* brings together the findings of the study and develops a great deal of information concerning adjustment before, during and after service.

This series of books is not one that will be read from cover to cover by many persons in or out of the Army. But it certainly appears that every person engaged in personnel work in or out of the service should seriously study the results. Likewise it behooves clergymen, educators, employers from all walks of life, union officials, and social scientists to glean as much as possible out of the study in search of answers to their own peculiar problems.

When President Eisenhower was soliciting funds for the conducting of this Conservation of Human Resources Project he listed some pertinent questions which he believed should be considered by a study group. These are: 1. Are these men generally from the uneducated groups? 2. Are they generally urban or rural in origin? 3. How do these men spend their leisure time? 4. Are they underfed or otherwise definitely underprivileged? 5. Do they show a long history of emotional instability, or do these defects come out only under fear

or other stress? 6. What has happened to them? Are they now a charge upon society or are they leading useful lives? 7. How accurate were our war-time yardsticks for measuring mental deficiency? and 8. What can industry, trade unions, the school, the church do to help reduce the volume of loss? Each one of these comprehensive questions is at least partially answered in these books.

At a conference held in the Pentagon early this Summer, President Eisenhower sent a letter to be read to the conferees by his personal physician, Major General Howard Snyder, who has been a driving force behind this study since its inception. In addition to still showing a deep, continuing concern in this project, the President stated in part:

> The more we can learn about the development and utilization of our human potential, the better position we will be in to realize our individual and national goals. It is essential, therefore, for work in human resources to continue—both at the level of basic research and equally important at the level where the research findings can be put into practice.
>
> With only six percent of the world's population, the United States has an obligation to itself as well as to the free nations of the world to assume leadership in the conservation of human resources, the key element in human betterment and economic development.

In order to offset the huge manpower differential between this country and the Soviets, it appears to this writer that we must take all steps possible at once to improve the quality of our citizenship. Many of us remember during World War II receiving literature explaining in detail "Why We Fight." And I am sure there are many troop information lectures given today as to why we are in Germany or any other place where members of this great U. S. Army are stationed. Such indoctrination should not have to be given to a man after he is inducted in the service. These basic principles of our American way of life should be given to the individual from his first day of school when he stands up and gives the Pledge of Allegiance to the Flag. These principles should be given as a combination of home training, formal schooling and religious indoctrination. So, when inducted into the Services, the training can continue but the basic motivating factors are already present. Too many times in the past decade has this writer heard someone state "Poor Johnny, he has to go into the service for the next two years." Consequently poor Johnny comes into the service with entirely the wrong attitude. During this excellent conference, Mr. Frank Pace, Jr., former Secretary of the Army, and presently the Chairman of the Board of General Dynamics Corporation, stated:

> I would like to think that in the period of emergency in which we live the citizen in a democracy will respond as readily to the requirements of his time as he does to those other three basic ingredients of American citizenship—to earn a livelihood, to support his family, and to live within the laws of the community of which he is a part.

This is the thought which should be inculcated in the youth of our nation prior to induction into the service. The requirement for military service is just as great in the present-day era as it was during the hot war. This must be developed by all our educators if we are to close the quantity gap by increasing our quality.

Not only will the services reap benefits by such a program but civilian industry as well when these individuals return to civilian life. The leaders of our country, in government, industry, education and religion, owe this to the youth of our nation, for never did we need to protect a more precious commodity—*the individual American citizen.*

Soviet Tank Superiority?

By CAPTAIN JOHN D. HENDERSON and CAPTAIN ERNEST KASSNER

PT76 light amphibious tank.

T54 medium tank.

THE importance of Armor, in modern warfare, is well established. Therefore, our tanks should be equal or superior in quality to those of the Soviets. What does a comparison of Armor actually in the hands of line units show?

Two tanks are available in quantity to the United States Army—the M41 light tank and the M48 medium tank. The Soviet Army has three types of tanks available in large numbers. These are: the PT76 light amphibious tank; the T34 and T54 medium tanks; and the JS3 and T10 heavy tanks.

Although Soviet assault guns have a very limited traversing capability, they must be considered as tanks in all other respects. The assault gun has a heavy tank chassis and hull, fully armored enclosed turret and is given an antitank mission.

Light Tank

A full comparison of the United States and Soviet light tanks is not appropriate because of their primary tactical mission of reconnaissance and screening, which requires the avoidance of full engagement in tank *vs.* tank combat. The Soviet PT76 light tank, first issued to troops in 1952, is now organic to the reconnaissance elements of all line divisions. It has the decided advantage of being fully amphibious, a capability notably lacking in our tanks. In the exploitation phase or in areas of numerous unfordable water barriers the PT76 has the capability of immediately crossing water barriers and penetrating lightly defended areas using its armor protection, firepower and shock action to exploit time and space factors unfavorable to opposing forces.

Medium and Heavy Tanks

In Soviet as well as U. S. doctrine the massed medium tank is the principal instrument of armor warfare, and the unit most often engaged in tank *vs.* tank combat. The primary medium tank in the hands of U. S. troops is the M48. Its Soviet counterpart is the T54. Issue of T54s to Soviet field units began in 1950 as a replacement for the T34/85. Replacement continues as rapidly as production permits. It has been reported also to be taking place in Czechoslovakia and Poland.

Comparative characteristics of the M48A2 and T54 indicate that the T54 has slightly superior firepower, substantially greater cruising range, a lower silhouette and less weight. One other advantage is that the T54 can be equipped with a chimney and snorkel type attachment which permits it to drive totally submerged through water 15 to 20 feet deep. This is not a developmental device, but one in the hands of troops, tried in maneuvers and used in training.

In the heavy tank class the Soviets have two models, the JS3 and the T10. The United States has the counterpart M103, but in very limited numbers, which presently precludes consideration as a significant opponent to Soviet tanks. The JS3 was developed and introduced during the later stages of World War II. The T10 was introduced and displayed at the 1957 Moscow parade and is essentially a refinement of the JS3. It has not yet been issued to troops in large quantities, but the percentage of T10s in total heavy tank strength can certainly be expected to increase as production continues.

Assault Guns

As discussed by Garrett Underhill in the January-February 1953 issue of *ARMOR*, United States armored forces do not have a counterpart to the Soviet JSU122 or 152 assault guns (tank destroyer). The primary mission of the assault gun is to repel enemy armored counterattacks and to provide fire support in the attack wherever tanks are employed. It is fully enclosed in armor and mounted on a heavy tank chassis. The superstructure is roomier than a tank turret, making it possible to mount a bigger gun on a given sized chassis. In addition, it is somewhat easier to manufacture. It is interesting to speculate, whether the Soviet's failure to introduce any new SU's in recent years has any tactical signifi-

CAPTAIN JOHN D. HENDERSON, Armor, was commissioned in 1949. He has attended three courses at the U. S. Army Armor School and the Language and Strategic Intelligence Schools. Recently completing a tour of duty with the G2 Section, Seventh U. S. Army, he is presently assigned to the 2d Armored Division, Fort Hood, Tex.

CAPTAIN ERNEST KASSNER, Armor, served as an enlisted man during 1943-46. In 1946 he received his warrant and was commissioned in 1949. He attended the Basic Intelligence Officers' Course at Holabird, and the Associate Advance Course at Knox. He commanded a company in the 11th ACR prior to his present assignment in the G2 Section, Seventh U. S. Army.

T10 heavy tank.

JSU152 assault gun.

cance. Be that as it may, assault guns in the hands of troops today are numerous and will not be considered obsolete in the near future in both the Soviet and Satellite armies.

Mechanized Support Elements

Support for Soviet tank and mechanized units is provided by a large variety of amphibious and nonamphibious personnel carriers, rockets and super-heavy artillery, which are fully tracked vehicles and in numerous cases mounted on tank chassis.

This variety of equipment is capable of accompanying Armor in cross-country movements, independent of existing road nets. This is an extremely important factor considering the meager road density in most areas of Asia, Eastern Central, Eastern Europe and the Middle East. The cross country mobility and flexibility of this equipment is given further importance on the atomic battlefield where the capability to disperse and mass both fighting and support units rapidly is vital to survival and victory.

Development and Production

The ability of the Soviets to produce a good, effective tank is not a recent attainment. Their ability to incorporate the best features of western Armor and original features demanded by Russian geographical factors into a well designed unit with outstanding characteristics resulted in the T34/76 and T34/85 early in World War II. When the T34/76 appeared on the Eastern Front in the summer of 1941, it was the best medium tank in the world. No less an authority than General Guderian can be cited on this point as far as German tanks are concerned. He states in *Panzer Leader*[1] that "the enemy employed his T34 tank, a tank against which our guns at that time were largely ineffective. . . . On Oct. 6, 1941 . . . the 4th Panzer Division was attacked by Russian tanks to the south of Mzensk . . . this was the first occasion on which the *vast superiority*[2] of the Russian T34 to our tanks became plainly apparent." With no essential difference other than substituting a longer barreled gun, now 85mm caliber, and substituting a roomier turret, the tank Guderian describes was the same that United States Forces met in Korea almost a decade later. Our troops did not find the T34 obsolete then; even though it was employed by North Korean and Chinese crews to whom Armor was then very new, and under the special tactical and terrain conditions prevailing in Korea.

In the JS3, and later in the T54, the Soviets perfected the sloped and rounded hull and turret design which is shaped to cause a maximum number of rounds fired against it to glance off due to an unfavorable angle of impact. The M48 was our first tank to use this feature which among production tanks, found its first application in the sloped frontal armor of the T34. Whether or not the Soviets were original in this or other features of their tank design is not significant. They were not the first to be offered the Christie suspension system; but they were the first to use it in a standard tank chassis.

Their ability to produce in large quantities simple, effective armor equipment was proven in World War II when a great portion of their industrial base was under German control. In *Red Army Today*[3] Colonel Ely says that "it is entirely probable that the Red Army had as much Armor in action against the Germans in the last two years of the war as the Germans had against the Red Army and the Western allies combined. Soviet production of armored vehicles in World War II was that of a major industrial power, reaching 30,000 per year." We cannot afford to underestimate Soviet capabilities to design, develop and produce Armor. Considering past accomplishments and the strides in general industrial development which the Soviets have made since World War II, they can be expected to introduce superior armor matériel in the future.

The question of how Soviet doctrine, skill in armor command, and crew ability to fight their tanks compare with ours has been intentionally left outside the scope of this article. These are essential factors in a complete appraisal of Soviet Armor and consequently no such appraisal is possible or intended here. It must await another, broader article.

---

[1] *Panzer Leader*, General Heinz Guderian, Ballantine Books, New York, 1957, pp. 136, 179.

[2] Italics ours.

[3] *The Red Army Today*, Colonel Louis B. Ely, The Military Service Publishing Company, Harrisburg, 1949, p. 40.

JS3 heavy tank.

T34 medium tank.

Powerful, Highly Mobile Tank Still Army Objective

By MARK S. WATSON*

WHEN Lieutenant General Arthur G. Trudeau, the Army's research chief, stated bluntly that even the newest tank, not yet off the production line, "doesn't suit me," he made it clear that Army research still has a long way to go in producing a tank that is both powerful and highly mobile.

The new M60 tank, it now is admitted, is still an interim vehicle. It is better than the improved M48 (The Patton) in that it has a much better gun and (thanks to use of Diesel power) almost twice the Patton's range.

It has dozens of lesser improvements, notably in transmission and in driving controls, but it still weighs almost as much as today's Patton, which means that it has little more of the nimbleness which is a prime need in the new mobile army.

To get something radically better, Army research is working energetically in several fields, notably in metallurgy, in order to produce alloys of greater strength, yet of less weight.

There have been blighted hopes, as in the case of much lighter tracks which industry has produced; the new tracks operated admirably during hundreds of miles of field tests, only to crack up too suddenly and too soon to justify installing them.

Research Goes On

Hence the new tank was ordered into production not because it meets all hopes but because it is better than the tank the United States has and is the best immediately available.

Meantime research continues, in this and other fields, in the hope of getting the tank's total weight down so sharply as to permit two aspects of field mobility—greater speed with the same engine, and much greater ability to move over any terrain.

A special point of study, now as always, is the tank's big gun—not only because the gun itself normally weighs three or four tons, but because the tank's structure must be extremely sturdy to support that weight plus the shock of the gun's firing.

Nor is this research project without promise, for there has been immense progress in weaponry in general, and it seems reasonable to expect in time a gun weighing very much less, with mechanisms imposing less strain in firing, and hence permitting a very marked two-fold reduction in the weight of the supporting structure.

Still Held Essential

The tank still is regarded by military planners as an essential in warfare. Far from being threatened by the nuclear age, the Army regards the tank's present role as greater than its former role, and predicts future tanks of very long range and carrying capacity in personnel.

This enhancement of value is due to evidence that armor is about the best defense against the nuclear radiation which must be recognized as a prime peril of future battlefields.

The tank and the armored personnel carrier therefore are regarded as essential to the battlefield mobility which is a first requirement of modern war.

The armor is perhaps more important as protection against radioactivity than as a defense against shell fragments.

It is worthy of note that the better gun of the M60 (105mm instead of the Patton's 90mm) is a British development. It provides an impressive example of a little known aspect of NATO activities, which include the pooling of scientific and technological resources of the NATO member nations, and assignment of responsibilities to each nation, thus avoiding duplication of effort.

By this pooling the British were given financial assistance in developing a better tank gun for all NATO nations. The M60's new gun is the result, now available for manufacture in the United States as well. Other devices being developed in France and the United States will in their turn be made similarly available to British weaponry.

The necessity of continuous betterment in use of the tank, as of other items in war's armory, is pointed out today by the recollection of what happened just 20 years ago, when German Armor swept rapidly over Poland at the outset of World War II.

Then, and even in 1940 when German Armor similarly crashed through the French Army, the Allies had appreciably more tanks than Germany possessed, but antiquated tactics made their tank superiority useless.

* This article appeared in *The Baltimore Sun* on September 23 and is reprinted here with the kind permission of the author. Mr. Watson is one of the leading military correspondents of the world.

(U. S. Army)

ALLY IN GRAY

By LIEUTENANT COLONEL JOHN W. HOPKINS, JR.

At the Start

THERE is a new military establishment developing in Central Europe. Its members wear the traditional gray uniform of the West German Army. They wear it with pride as they march to their strategic positions among the key defenders of the North Atlantic Treaty Organization (NATO).

LIEUTENANT COLONEL JOHN W. HOPKINS, JR., Armor, served in Pacific during World War II with the 1st Cavalry Division. Subsequently he served in the Constabulary and as an instructor at C&GSC. Recently he completed a two and one-half year assignment with MAAG, Germany. He is presently with the U. S. Army Combat Surveillance Agency, Washington, D. C.

This military establishment—and the rapidly developing army that forms its major part—stemmed from the genius and statesmanship of a West German patriarch named Konrad Adenauer, Chancellor of the Federal Republic of Germany.

Very few people need to be reminded of the destruction, the sense of defeat, the terrible hunger, the poverty, or the revolt against anything that pertained to the military, that existed in Western Germany in the years after 1945. Occupying armies (benevolent or otherwise is immaterial) were billeted on West German soil, occupying needed West German houses and facilities and, to use an Anglo-Saxon expression of World War II, were "over-fed and over here."

These conditions are past and the fact that Chancellor Adenauer rose to the challenge of political leadership in Western Germany during these trying times is history. The fact that, under his leadership, Western Germany spring-boarded Marshall Plan aid into an economic colossus, though history still rings in our ears —if only to the tune of the more than occasional Volkswagen on Main Street. But the history that is relevant to a discussion of the West German Army of today fills volumes and, to limit this story, some starting date must be imposed. Because today's army of the Federal Republic of Germany dates only to January, 1956, we can logically start there if we reserve the right to go back a little bit farther, if necessary, in the course of our story.

There is a German town called Andernach that lies on the West

In January 1956 at Andernach, Germany, the Army of the Federal Republic of Germany was born. Its progress to date is a tribute to the German Army Officer and Noncommissioned Officer Corps. Lending an assist were members of the U.S. Army whose slogan was "Cooperation."

Bank of the Rhine River. It is some 15 miles South of the point where a handful of American soldiers once captured the Remagen bridge. Andernach is an old walled city that dates back to the days of the Romans and each year tourists of many nations visit the town and walk along its ivy-bordered ways. In January, 1956 it was the birthplace of West Germany's new Army.

The First Steps

It is a terrific job to start an Army in a country where no Army exists. Obviously, there is no base—no nucleus—on which to build. There is an absence of personnel, procedures, depots and military facilities of all sorts and an absence of supplies and equipment. Many readers will recall the mobilization problems of the United States in the early '40's. These problems, real though they were, were moderated by the fact that the United States had a small standing Army and a reservoir of Reserve and National Guard personnel that could be used to swell the base upon which mobilization was to take place. The Federal Republic of Germany had nothing but the determination to terminate the 11-year void in her military history, a sound economic system and a reasonably healthy and well educated population of 53,318,000.*

West Germany's new Army was inaugurated in January 1956 and its complete roster consisted of a handful of staff officers of the Federal Ministry of Defense in the Bonn-Cologne area and a training battalion of some 400 officers and men that was garrisoned in the old town of Andernach. Modest as it was, this group was to be the nucleus of a modern Army of 12 divisions and about a quarter of a million men.

West Germany's first soldiers—and for that matter virtually all who entered the Army in 1956—were veterans of World War II. Returning to the colors from patriotism and from a love of the military art, many of these early volunteers did so at considerable personal sacrifice. For example, a successful practicing physician—highly decorated for bravery during World War II—returned to the Army as one of its early infantry battalion commanders.

The fact that those who entered the Army early were preponderantly veterans resulted in the West German Officer Corps and Noncommissioned Officer Corps being somewhat over-age. It also resulted in a distinct shortage of the Lieutenants and Captains that are so necessary during mobilization. The absorption of undesirable age "humps" of this sort requires a period of years in any Army and this one will plague Germany for some years to come.

Despite the personnel problems, the equipment problems, the necessity to procure and to build or to refurbish barracks and the myriad other difficulties that were encountered, the West German Army grew in strength during the months of 1956. West German planners recognized the fact that the first essential in the development of their Army would have to be the establishment of a series of schools that could produce the specialists that a modern Army demands and that could re-awaken the study of the various military arts. First priority was given to this task—and by the closing months of 1956 schools for tank crewmen, for infantry soldiers, for communication specialists and for the cooks and clerks and vehicle drivers that an Army demands, were in existence.

United States' Support

The basis of any successful military plan is timeliness, and United States Army planning for the support of the West German Army was commenced sufficiently in advance to insure that it would provide for that support which the West German Army would need during the initial stages of its activation. The plan for the provision of United States' support to West Germany envisioned this support as falling into two categories —logistic support and training support.

The logistic support that was to be provided to the Army of the Federal Republic of Germany was to consist of limited quantities of modern arms which could not initially be produced in West Germany and which would be given to West Germany under the provisions of the Mutual Defense Assistance Program. It was envisioned —and envisioned correctly—that this initial quantity of equipment would enable the West German Army to gets its activation program under way. Provision was also made by the United States to enable the Federal Republic to purchase from the United States additional quantities of tanks, guns and other equipment that they themselves foresaw as being necessary to their continued activation. West Germany received a very high priority for the delivery of equipment, and the equipment that was delivered was of late design and excellent quality.

The training assistance plan of the United States involved charging the United States Army, Europe with the responsibility for providing West German Army units with teams of highly selected United States Officer and NCO instructors, with training aids and, in some instances, with items of equipment needed for instruction.

In anticipation of the activation of the West German Army in January, 1956, the United States Army, Europe staff in early 1955 commenced

**Statisches Jahrbuch Für Die Bundesrepublik Deutschland 1957*, W. Kohlhammer, G.M.B.H., Stuttgart.

the preparation of a detailed plan for providing training support. This planning was accomplished in close coordination with a West German planning group which was known as the Blank Office and which subsequently developed into the Ministry of Defense of the Federal Republic of Germany.

The training support that was envisioned proved to be almost indispensable to the orderly development of the West German Army. During the 11 year non-existence of an Army in West Germany, equipment had developed tremendously in complexity. This complexity, plus the fact that, to the West German soldier, the equipment was of foreign manufacture, compounded the West German problem of having no nucleus upon which to develop its Army. The training that was conducted was restricted almost entirely to instruction on U. S. equipment, its use and its maintenance. The German Officer and NCO were quite adequate in conducting their own training in other fields.

United States Army, Europe has its headquarters in the old German University town of Heidelberg. The seat of Government of West Germany is located at Bonn, some 200 miles to the North. While United States Army, Europe could provide the training support required by units of the West German Army, it would have been difficult for that Headquarters to have performed an advisory function at Bonn and to have effected the coordination necessary to the delivery of military supplies to the West German Army. As a consequence, the Military Assistance and Advisory Group to the Federal Republic of Germany was established in late 1955. This was and is a tri-service organization and its Army Section has been charged with rendering assistance to the German Ministry of Defense, coordinating the delivery of Army material, coordinating the training of West German Army personnel that the Ministry of Defense desired to send to USAREUR Schools and to schools in the continental United States, and observing West German utilization of United States-furnished equipment.

The Costs Involved

It costs a great deal to raise or to maintain an Army. The salaries paid to the soldiers of a single United States Infantry Division amount to over $36,000,000 a year and this is but a small part of the cost of such a division. This figure does not even include the cost of the food that is consumed by the Division's 15,000 members—much less their housing, their clothing and their very costly equipment.

Of the U. S. equipment that was given to West Germany to aid in the initial activation of West German Army units, the value of tanks and artillery pieces furnished amounted to the most of U. S. cost. The tanks furnished were the M47 medium and M41 light tanks. These are modern vehicles of post-World War II design. The fact that the M47 tanks did not reach the battlefields of Korea until the end of that action is an index of their modernity.

Despite the fact that the M47 tanks were good vehicles, the U. S. Army had recently introduced a later tank, the M48, into Europe as its standard medium tank. This later model vehicle offers some advantages over the M47. (We hope to have M60's available to replace the M48's in the not too distant future.)

First Class has been the slogan of the West German Army planners. The last M47 tank had hardly been delivered when the West German government commenced negotiation for the purchase of M48 tanks—at the U. S. government's own price.

The glowing economy of West Germany was capable of furnishing the trucks, the jeeps, the uniforms and the housing that the West German Army required. The West German Army bought many additional items such as helicopters and ammunition from the United States and from European nations.

West Germany defrayed a very significant part of the cost of the training support that was given her by the U. S. Army. American instructors engaged in this program have been furnished with West German vehicles and gasoline. Offices, furniture, supplies and per diem traveling allowances for U. S. personnel in this program have been provided at the expense of the West German Government.

The point of interest here is the fact that Western Germany has picked up the preponderance of the tab—and it has been a big tab indeed —in the development of her Army.

Cooperation

The highlight of the relationship between U. S. Army personnel and West German Army personnel has been cooperation. The requests made by the West German Army for instruction, schooling, and equipment that it has desired to purchase have been realistic and practical. The

(U. S. Army)

Instruction and schooling given West German Army is realistic and practical.

(U. S. Army)

Classroom instruction—two sergeants discuss operation of a T41 range finder.

United States Army men that have worked with the West German Army have been cooperative—they should be, for that has been their job—and have been helpful in their attitudes. Close working relationships have existed between the two Armies involved and there have developed many friendships that will be long lasting.

A remarkable degree of cooperation has existed between United States Army, Europe, its subordinate Seventh United States Army and the Military Assistance Advisory Group to West Germany. The clear guidance of the U. S. Department of Defense and Department of the Army and the unanimity of purpose of General Henry I. Hodes, USAREUR Commander-in-Chief, Lieutenant General (now General) Bruce C. Clarke, Seventh Army Commander and Major General (now Lieutenant General) Clark L. Ruffner, former dynamic Chief of the Military Assistance Advisory Group to West Germany, insured this cooperation.

The Army Build-Up

By late 1956, the West German Army school system had been established. At this time none of the schools had developed to the point that they could graduate soldiers trained in one specialty or another in anywhere near adequate numbers—nor was such a state of development to be achieved for another two years. The schools were, however, producing a few graduates that in time would be able to serve as instructors and thereby to broaden the training base of the West German Army.

The West German Army commenced the activation of its first tactical units in late 1956. This represented another great step forward but it produced another symptom of the Army's inadequate training base at that time. West German units were faced with the very difficult task of training themselves to standards of reasonable proficiency while, at the same time, being faced with the necessity of providing cadres for other units that were being activated.

When an Army is expanding rapidly and is involved in absorbing large numbers of untrained people, the proficiency of the elements of that Army is bound to suffer. The West German military planners were faced with the necessity of expanding rapidly in order to meet their 12-division goal in the early 1960's. To conduct this rapid expansion they had to accept mediocrity in the state of training of their forces during the proposed period of expansion.

By the end of 1958 this Army had progressed almost to a halfway point as far as numbers of men were concerned. Eight of the proposed 12 divisions had been activated, and although many deficiencies in the training of units were still apparent, tremendous progress was becoming evident.

Like earning your first million dollars a new Army's first 1,000 men, or first 10,000 men, or first 100,000 men is the hardest to acquire.

(U. S. Army)

Shown here is one of the first companies of the West German Army marching.

(U. S. Army)

West German Army officers are efficient and take pride in their profession.

The West German Soldier

Intelligence, the love of his own country and a high state of personal integrity characterize the West German soldier. He is hardy and is well-educated by American standards. He is the product of one of the most highly industrialized nations on earth, and, as such, is far better adapted to mechanical things than are the citizens of most countries of the world.

The young German soldier tends to pursue military information and to take to the military life reasonably well. This characteristic is rather unfavorably influenced by recent German history, which is only natural. West German military authorities are presently utilizing an extensive job information program and publicity campaign in an effort to stimulate interest in the West German military establishment on the part of young men.

It is natural that different military heritages will lead to different ways of doing military things. In the fields of rifle marksmanship, equipment maintenance and the conduct of training, the West German Army tends to use systems that are somewhat different from those of the United States. There are certain characteristics of the German systems that the Germans believe to be well-suited to their requirements. The Army is Western Germany's and the systems that best meet the needs of the officials of that Army will probably be used or adopted.

The West German Army Officer is polite, reserved and somewhat formal, but he is in no wise cold. He has a good sense of humor, is efficient, takes great pride in his profession and, although he has a great respect for authority, he is not indifferent to the feelings of his subordinates. It is very difficult to find in today's West German Army the type of be-monocled personality that in years gone by was so adequately portrayed on the screen by the late Erich von Stroheim.

And the Future

In the early days of the West German Army there was resistance—some undoubtedly Communist inspired—among the West German populace to the rearmament of Western Germany. As the development of the West German Army proceeded, as the Ministry of Defense developed an effective scheme of publicity for its Armed Forces and as the West German soldier came to be seen on the streets in his neat gray uniform, this resistance subsided. It is only reasonable to assume that, with the passing of time, there will come more and more national pride in the West German Army.

Enhanced national pride in the West German Armed Forces will influence recruiting favorably. It will attract additional recruits, more professional soldiers and will enable the West German Army to develop a high degree of effectiveness. Remember that until now, the development of this high degree of effectiveness has had to be secondary to the attainment of the Army's growth.

Several things point to the strength of the alliance of West Germany with her Western neighbors and with NATO. One of these things is economics—and wars and alliances stem from economics. West Germany is an industrial nation and relies heavily on other NATO nations for raw materials and as customers for the steel, automobiles, trucks, industrial machinery and the engineering works that she produces. West Germany's favor for the establishment of the Common Market Area demonstrates her economic ties to her Western neighbors.

An additional factor which will react in favor of West Germany's alliance with NATO is the contrast between post-war treatment of Western Germany by the Western powers and by the Soviet bloc. Too, West Germany has witnessed first-hand the fate of the Central European Nations taken under Communist control.

So, from the foregoing we can conclude that the early 1960's will find a well trained West German Army—an Army that is closely joined with forces of the other NATO powers. Because of the policies of the German Federal Ministry of Defense to purchase only the best and most modern weapons, this Army will be well equipped for success in battle.

Our ally in gray will do her part.

The first comprehensive presentation of

Tank Armament

By RICHARD M. OGORKIEWICZ

(U. S. Army)

The tank is basically a weapon carrier—a vehicle which serves to increase by its mobility the effectiveness of the armament mounted in it—and its capabilities center largely on the weapons it carries.

FEW developments have had such a profound influence on the evolution of the tank as its armament. This is natural because the tank is basically a weapon carrier–a vehicle which serves to increase by its mobility the effectiveness of the armament mounted in it—and its capabilities center largely on the weapons it carries. In consequence, trends and developments in the field of tank armament are always a subject of the greatest importance. Moreover, they deserve particular attention at a time such as this when new guns are being introduced in the basic medium tank category. It is, therefore, more than ever desirable to survey the field, in order to maintain a proper sense of perspective and to arrive at an objective assessment of the current position.

RICHARD M. OGORKIEWICZ, a frequent contributor to *ARMOR* presents here, what is believed to be, the first comprehensive round-up of tank armament. He is the author of a forthcoming book soon to be published, entitled *Armor: An Outline of the Development of Mechanized Forces and their Equipment.*

Basic Requirements

Approached from first principles, the characteristics of tank armament and its effectiveness may be simply related to its ability to disable or destroy hostile personnel, weapon emplacements and combat vehicles. When tanks were first developed during World War I the need to combat armored vehicles did not exist and the other two main functional requirements were met by a combination of two different weapons. One was the machine gun, which answered the need for an anti-personnel weapon; the other was the gun which fired high explosive shells necessary against dug-in machine guns.

The combination of machine guns with guns has since remained the common basis of tank armament. Tank machine guns have remained, as they were, adaptations of rifle-caliber infantry weapons. Tank guns, on the other hand, have changed very considerably over the years.

The guns of the first British tanks of 1916 were light naval guns which happened to be available at the time and which were considered powerful enough against machine gun emplacements. They were of 57mm caliber but were designated in the archaic manner still used by the British Army as six-pounders. Subsequently, as production of tanks got under way, a special short-tube tank version of the same gun was manufactured which was only 23 calibers long and had a muzzle velocity of 1,350 ft/sec. This second version was used in most of the gun-armed British heavy tanks and the Anglo-American Mark VIII of 1918, and also in post-war U. S. experimental medium tanks down to the T1 of 1925.

In Britain, in the meantime, a new fashion set in for smaller caliber guns of 47mm. This was introduced with the first Vickers light tank of 1921 and continued as the heaviest British tank gun up to the mid-30s not only on medium tanks but even on the 35-short-ton A.1 Independent heavy tank. By comparison with the original guns, the 47mm gun possessed the advantage of higher, 1,750 ft/sec muzzle velocity and consequently flatter trajectory and greater accuracy. But their lighter shells were far less effective. This, however, was in keeping with the contemporary British armored doctrine which no longer saw the need for an effective shell-gun in tanks. In fact, the gun was regarded as no more than an adjunct to the machine gun which erroneously was elevated to the position of the principal tank weapon. According to some contemporary views the only real need for a tank gun was to fight hostile tanks, and small-caliber guns were considered adequate for this.

Limitations of Early Armament

A tendency to concentrate on machine guns actually originated with the "Female" versions of the British heavy tanks of World War I, which were only armed with five or six machine guns, and manifested itself most clearly in the multi-turret tanks of the 20s, such as the Independent which had four small machine gun turrets grouped round the main 47mm gun turret. However, the machine gun complex was not confined to Britain. Among others, it affected the United States, and the Medium M2-E1 of the mid-30s actually carried the record number of nine machine guns, including two mounted externally.

All such emphasis on machine guns was at the expense of other weapons and had an adverse effect on the overall capabilities of tanks because of the serious limitations of the machine gun armament. The limitations were demonstrated most clearly by the light two-man tanks popularized in the early 30s by the Vickers-Carden-Loyd designs. Because they were only armed with machine guns, the offensive capabilities of such tanks were very limited and they could only perform auxiliary or secondary roles. As for hostile tanks, they were just powerless in face of them.

The inability to fight hostile tanks was more difficult to ignore than the lack of shell-power and by the mid-30s even light tanks were provided with some type of armor piercing weapon in addition to one or more rifle-caliber machine guns.

Small-caliber Guns

The smallest of the small-caliber armor piercing tank weapons were heavy machine guns of caliber .50 (12.7mm) to 13.2mm. Weapons of this size came into the anti-armor field with the German 13mm antitank rifle of 1918 and the dual-purpose, *Tank und Flieger,* antitank and anti-aircraft heavy machine gun which the German Army was about to introduce when World War I ended. The ammunition of the latter gun served as a model for the U. S. caliber .50 machine gun which became the heaviest U. S. tank weapon during the middle 30s even on the Medium T4, and continued on light tanks from the T2 of 1934 until 1940.

The different 12.7 to 13.2mm Browning, Vickers, Hotchkiss and other heavy machine guns were reasonably effective against the light armor of the 20s but by the late 30s they were definitely inadequate against armored vehicles. As for other ground targets their effectiveness has always been questionable as they are more powerful than necessary against personnel and not powerful enough against most other targets.

A happier choice among the small caliber antitank weapons were 20mm automatic cannon evolved from the German Becker gun of 1918. Developed under German auspices in Switzerland by the Oerlikon and Solothurn organizations they have been used on some scale as antitank, as well as widely as antiaircraft weapons and were mounted as the main armament of the German Pz.Kpfw.II, Soviet T60 and Italian L6 light tanks up to 1942 or so.

Useful as the 20mm guns might have been when they were introduced, in the late 30s the minimum caliber considered necessary for tank guns was 37mm. It is of interest to note that this peculiar caliber was originated by Benjamin Hotchkiss, the American-born designer of several outstanding French weapons, as a result of the limitations imposed by the St. Petersburg (now Leningrad) Convention of 1868 on the minimum weight of explosive projectiles. In tanks it first appeared with the mounting of the French light infantry cannon in the Renault F.T. light tank of 1917, from which it was carried over into the standard U. S. light tank of the 20s—the Renault-modelled M1917.

The French *37mm S.A. Modele 1918* was only 21 calibers long and had a muzzle velocity of 1,270 ft/sec. In spite of this, it continued to be mounted in French light tanks built during the late 30s and was used in numbers during the 1940 campaign in the West. However, by then the length of other 37mm tank guns had

increased to over 30 calibers, or even over 40, and their muzzle velocities to 2,000-2,900 ft/sec. Somewhat larger caliber tank guns were also being introduced, as shown by the British 40-mm, Soviet 45mm and French, Czech and Italian 47mm.

Thus, on the outbreak of World War II typical tank guns of the basic medium tanks of 10 to 20 tons were of 37mm to 47mm, capable of penetrating 40mm to 60mm of armor at 500 yards at normal impact. This fulfilled adequately the contemporary requirement for an armor-piercing tank weapon. What the 37-47mm tank guns did not have was shell-power to deal effectively with such targets as hostile antitank guns. In this one respect, in fact, the average tank of 1939 was inferior to the original British and French tanks of 1916-17.

In Britain an attempt was made to remedy the situation after 1930 by introducing into tank units a limited number of special "close support" tanks, which were standard tanks re-armed with 94 or 76.2mm howitzers in place of the 47 or 40mm guns. But these limited-purpose tanks did not prove a success and the "close support" tank concept was abandoned by the British Army in the latter part of World War II. However, a similar concept reappeared almost immediately in the shape of the U. S. M4 and M26 tanks armed with 105-mm howitzers.

75mm Tank Guns

In contrast to the early British ideas which favored machine guns and small caliber guns, the artillery minded French went in for good size guns from the start. The original Schneider tank carried a shortened version of the famous 75mm field gun and the St. Chamond, which came second, a normal *soixante-quinze* 36 calibers long and with a muzzle velocity of 1,790 ft—sec. The French pursued this eminently sound line of a 75mm gun battle tank after World War I but unfortunately they took so long over the development of the next model, the B1, that by the time it was produced in the mid-30s it was obsolescent. There is an ordnance development lesson in this for all time.

Others, who took up 75mm tank guns after the French but moved faster, did much better. The Germans started in 1926-28 with a secretly built medium tank and from this, through the multi-turret Nb.Fz. of 1933, evolved the Pz.Kpfw.IV of World War II; all three had 75mm guns 24 calibers long. The Russians started in the early 30s with the T28 and T35 which had 76.2mm guns 16.5 calibers long and drew abreast of the Germans by mounting longer, 26-caliber guns in later versions of the T28. Then, in 1940, they jumped ahead of everybody else by going to even longer 76.2mm guns, first of 30.5 and then 41.5 calibers, on the KV heavy and T34 medium tanks. The United States made a late start in 1940 with the Medium M3, which carried a 75mm gun 31 calibers long, but caught up with the Russians in 1942 with the Medium M4 whose gun was 40 calibers long. By then the Germans regained a slight lead over everyone else by going to still longer, 43 and 48 caliber, guns on the Pz.-Kpfw.IV.

Combined with machine guns, the 75 or 76.2mm guns of the Pz.Kpfw. IV, T34 and M4 fulfilled all the main functional requirements. Muzzle velocities of the 75-76.2mm tank guns had reached 2,000-2,400 ft/sec and in 1942 they were effective against hostile tanks, as well as high explosive fire. An exception to the general trend was provided by the British policy which still clung to smaller caliber guns as the principal tank weapon. In consequence, in 1942 and 1943 tanks such as the Churchill, Crusader, Centaur and Cromwell were all armed with a new 57mm six-pounder. It was only reluctantly that a "general purpose" 75mm gun was adopted in 1943, in spite of the fact that lack of shell-power had proved a severe handicap to British tank units in the Libyan desert campaigns of 1941 and 1942. The 75mm gun itself was almost identical with that already used in U. S. medium tanks.

More Powerful Guns

In 1943, however, the 75mm gun formula of 1941 had already outlived its usefulness. More powerful tank guns were necessary to match the new guns of hostile tanks and to defeat their thicker armor. The German answer to this problem was to go to a still longer 75mm gun, 70-calibers long and with a muzzle velocity of 3,068 ft/sec on the Panther medium tank and to an 88mm gun on the Tiger I heavy tank. The latter was a tank version of the "eighty-eight" which had already earned fame as a dual-purpose, antiaircraft and antitank, gun. The Russians followed quickly with a similar 85mm gun on the KV85 and T34/85. On the other hand, in Britain and the United States the introduction of comparable guns lagged behind, due largely to the false doctrine which was rampant at the time that tanks should not be expected to combat hostile tanks and that it was unnecessary, therefore, to mount more powerful guns than the existing 75. The result of all this, so far as the Anglo-American tanks were concerned, was an inverse of the pre-World War II situation: then most tanks were being provided with adequate, for their day, armor-piercing weapons but lacked shell-power; now they had reasonable shell-guns but these guns no longer had sufficient armor penetration.

Fortunately, sane views finally prevailed and in 1944 the Medium M4, which had become the standard tank of the Allied armies, was re-armed with the more powerful U. S. 76mm gun or the British 76.2 mm 17-pounder. Just before World War II ended, the U. S. Army also introduced the M26 Pershing with a 90-mm gun whose 2,800 ft/sec muzzle velocity was comparable to that of the earlier German 88mm and the Soviet 85mm.

However, the Russians and the Germans had already moved a stage further. In 1944 the former had introduced the 122mm gun on the Stalin heavy tank and the latter an improved 88mm with a muzzle velocity of 3,300 ft/sec. The Germans also had the Jagdtiger with a 128mm gun which could penetrate 230mm of armor at 1,000 yards, at normal impact, and which was actually the most powerful tank gun used up to the end of World War II.

Caliber and Weight

So far as the majority of medium tanks were concerned, when World War II ended they were armed with 75mm to 85mm guns with muzzle velocities of 2,600-3,000 ft/sec. After the war, in the late 40s, the average caliber of medium tank guns increased still further with the adoption of 90, 83.9 and 100mm guns on the M46 Patton, British Centurion

3 and Soviet T54 respectively. Postwar light tanks, which had generally lagged one step behind the mediums, also acquired more powerful guns of the type previously used on the latter. On the other hand, the armament of heavy tanks stabilized itself at about 120mm, although guns of 150mm were being considered toward the end of World War II for the German E.100 heavy tank, and the U. S. T30 experimental heavy tank actually mounted a 155mm gun. However, the British Conqueror and the French AMX heavy tanks, as well as the U. S. M103, have been armed with 120mm guns while successive models of the Soviet Stalin retained the 122mm.

In fact, at about 120mm and muzzle velocities of the order of 3,000 ft/sec the development of conventional tank guns and ammunition had just about reached its practical limit. The main object of the development had been to achieve progressively greater armor penetration. In essence, this meant achieving sufficient kinetic energy at the target to be able to penetrate the armor plate of hostile tanks by a combination of projectile weight and velocity, kinetic energy being, of course, half the product of projectile mass and the square of its velocity.

Progressive increases in caliber from 37 to 120mm increased projectile weight from about 1.5 lb to 60 lb but the larger caliber also meant a larger diameter hole and more work to be done in penetrating a given thickness of armor, so that performance increased in proportion to the caliber of the projectile rather than its weight—which increased as the cube of the caliber. At the same time, as the caliber increased so did the weight of the tank gun which is roughly one hundred times the weight of the projectile. Thus, only very heavy vehicles could carry guns of the 120mm class.

High Velocity Ammunition

Increasing muzzle velocity, which rose from less than 2,000 ft/sec to more than 3,000, brought somewhat better returns initially but rapidly approached its limit at the latter figure. Higher muzzle velocities necessitate disproportionate increases in tube length, chamber pressure and weight of propellant while tube life decreases rapidly as muzzle velocity increases. Once this limit was reached with any given tank gun the only way to obtain increased armor penetration was either to increase the gun caliber or else to depart from orthodox designs, particularly in ammunition.

The latter line of development was actually opened before conventional guns approached the limits of caliber or muzzle velocity or even before conventional tank ammunition reached the degree of refinement common already to naval guns. In other words, before tank gun projectiles acquired armor piercing caps to assist penetration and ballistic caps to reduce air resistance. The improved, or APCBC, ammunition begun to come into use in 1942 but a year earlier the Germans had already introduced in their standard 37mm and 50mm guns a new type of armor piercing shot. This was of composite construction and consisted of a hard tungsten carbide core in a soft light-metal jacket. As it was lighter than the conventional AP projectile fired from the same gun the composite shot could attain a higher muzzle velocity and it made penetration easier as the latter was confined to the smaller diameter of the sub-caliber hard core. The disadvantage of this type of shot was its cost and its rapid loss of velocity and performance with range, due to the fact that it was lighter than the normal AP projectile and yet retained the same frontal area. Nevertheless, this type of high velocity armor piercing shot (HVAP) or, in the more precise British designation, composite rigid shot (APCR) was used with some success by the Germans in 1941 and their example was followed quickly by the Russians who started using similar ammunition in 1942. Two years later, in 1944, the high velocity tungsten core ammunition was also introduced on U. S. 76mm and 90mm guns, as already described in *ARMOR* by other writers.

To achieve still higher muzzle velocities, several countries had begun work before World War II on weapons with tapered or cone bores—originated in Germany by Gerlich. In 1941 the Germans introduced the first antitank weapon of this type with 28mm at the commencement of rifling and 20mm at the muzzle which fired a tungsten core shot with a muzzle velocity of about 4,600 ft/sec. Two larger, 42/30 and 75/55mm, cone bore antitank guns were also introduced at about the same time but because of a shortage of tungsten in Germany the use of all three was limited and none was applied to tanks. In fact, the only tank application of the cone bore gun was in an adaptation of the British 40mm two-pounder on the Tetrarch airborne light tank of 1944 D-Day fame. In general, this type of equipment produced the desired high velocity but, in addition to production costs and short tube life, it also had the serious drawback of less effective high explosive ammunition.

A more practical type of very high velocity armor piercing ammunition which could, moreover, be fired from conventional parallel bore tank guns was the APDS, or discarding sabot, type. This was a logical development of the light tungsten core ammunition which discarded its envelope or jacket after leaving the muzzle and thus reduced air resistance of the armor piercing sub-caliber core in proportion to its cross sectional area. In consequence, the velocity and penetration of the APDS type falls off less rapidly with range than the HVAP.

The discarding sabot type of ammunition was introduced in 1944 for the 57mm six-pounder guns of the British Churchill infantry tanks just in time for the Normandy operations. By the end of 1944 it was also supplied for the 76.2mm 17-pounder where the muzzle velocity of the APDS was 1,000 ft/sec higher than the 2,950 ft/sec of the standard APCBC and at 1,000 to 2,000 yards its penetration was about 50 percent greater. Nevertheless, by the end of World War II APDS ammunition was still something of a novelty but since then its use has considerably increased, pioneered largely by the British.

Yet another type of high-velocity sub-caliber ammunition was being worked on in Germany when World War II ended. It was fin-stabilized and fired from smooth bore guns but so far this type has not appeared in service. Instead, smooth bore guns have been applied to an entirely different type of armor piercing ammunition. This is the shaped charge ammunition which, of course, does not

rely on the kinetic energy of the projectile but on the focussed blast energy of its explosive content. To be more precise, the shaped charge, or HEAT, ammunition functions by virtue of the fact that on detonation the thin metal liner of the conical cavity in the nose of the projectile forms a long thin jet travelling at very high velocities, of up to 30,000 ft/sec, and that the impact of this very high velocity jet produces extremely high pressure which perforate the armor.

Shaped Charge

The first tank use of the shaped charge shells appears to have been made with the German Pz.Kpfw.IV medium of 1942 but the use of similar ammunition spread quickly to other weapons. Among the early applications of the shaped charge were several antitank rifle grenades, the British PIAT (Projector, Infantry, Antitank) spigot mortar of 1943 and the German *Panzerfaust* recoilless antitank grenade discharger of 1944. The latter, with a six-inch diameter projectile, was able to penetrate as much as 200mm of armor at normal impact.

Of the different applications, the use with conventional guns was the least successful because the spin of their projectiles interfered with the efficiency of the shaped charge. Nevertheless, the use of shaped charge projectiles has continued with rifled guns, particularly of the recoilless type.

As described by this writer in the September-October 1953 issue of *ARMOR*, recoilless guns were introduced into regular service by the Germans in 1941 as light airborne guns but subsequently their application was also considered in several armored vehicles. From the point of view of vehicle installation recoilless guns are almost ideal on account of their light weight and absence of recoil loads and they made it possible, for the first time, to mount powerful weapons on the lightest armored vehicles. However, the development of armored vehicles with recoilless guns was very slow and it was only in the mid-50s that a few such vehicles appeared in Japan and France, as well as the United States in the shape of the Ontos adopted in 1956 by the U. S. Marine Corps.

The slowness in the development of recoilless gun armored vehicles is most unfortunate in view of the need for lightweight armored vehicles, particularly in airborne operations, and of the equal need to make recoilless guns as mobile as possible because of their conspicuous back blast which gives away their position and makes it essential for them to change their positions quickly and frequently. Apart from back blast, the other main drawback to recoilless guns is their well known propellant consumption and the consequent bulk and weight of their ammunition.

Because of the shortcomings of recoilless guns the Germans had by 1945 already developed another type of weapon for use with shaped charge ammunition. Logically they went to fin-stabilized projectiles fired from smooth bore guns and evolved the 8cm PAW 600. In addition they employed a perforated throttling plate interposed between the propellant case and the projectile which reduced the peak loads on the projectile and the gun. The shaped charge projectiles of this ingenious light antitank gun were stable and accurate at up to 700 yards and could penetrate 140mm of armor. The guns had undergone successful troop trials toward the end of World War II and a larger caliber version was contemplated for use on the *Panzerjager 38t* light tracked tank destroyer. However, it was only in 1955 that a weapon of this type actually appeared on an armored vehicle—the Swiss four-wheeled Mowag tank destroyer.

The next logical step would have been to extend the range and accuracy of the fin-stabilized projectiles by rocket assistance or to go to rockets fired from closed-breech launchers. But, so far, neither type has appeared in service in spite of the extensive use of shaped charge rockets with such short-range infantry antitank weapons as the original U. S. 2.36-in "bazooka" of 1942 and various more recent rocket launchers.

Guided Missiles

Instead, the next and latest armor piercing weapon to come into the picture is the short-range surface-to-surface guided missile. This missile, in its antitank form, is essentially a rocket with a shaped charge warhead which can be controlled in flight to achieve a high degree of accuracy.

The beginning of antitank guided missile development has been described by this writer in another article, in the March-April 1957 issue of *ARMOR*. Since that article was written the use of antitank guided missiles has increased considerably and they have been used for the first time during the 1956 Sinai operations where the Israeli Army successfully employed some French-made S.S.10 missiles against the Soviet-built Egyptian Armor. Increasing attention has also been given to the use of guided missiles in armored vehicles.

Missile launchers, like recoilless guns, impose no firing loads and can be installed therefore in the lightest armored vehicles. The main disadvantage of the antitank guided missiles in this respect is their bulk, for even the Vickers 891 light infantry guided missile, the smallest model so far released, has a span of 11 inches over its aerodynamic lift and control surfaces. The installation of several guided missiles in a vehicle is consequently difficult. The rate of fire is also slow on account of the inherent limitations of the command-control systems used, and the flight time of the missiles is relatively long. Nevertheless, guided missiles have opened the possibility of light highly mobile armored vehicles which can attack the most heavily armored hostile tanks. The pioneering French S.S.10 missile can penetrate as much as 400mm (about 16in) of armor at normal impact and more recent missiles can do even better, placing serious doubt on further development of very heavy tanks.

Other probable targets remain to be dealt with by other means. For instance, it is unlikely that the guided missile will be used as a general-purpose high-explosive carrier while the machine gun is likely to remain as the principal anti-personnel weapon. Thus, the future of effective tank armament appears to lie more than ever in a combination of weapons which will provide the necessary ability to attack the main types of battlefield targets. The provision of these weapons demands continuous close attention to the problem both by the user arm and the technical services and more vigorous development effort than that evident on several past occasions.

The program for the development of self-propelled artillery is responsive to the need for increased ground mobility, greater operating range, air transportability and reduced maintenance requirements.

Self-propelled Artillery Development

The Self-propelled Carriage, T236 is being developed to meet the requirement for a lightweight, self-propelled carriage capable of mounting, interchangeably, the 8-inch howitzer, 155mm gun and 175mm gun and wrecker kit. Mounting the 8-inch howitzer, the 155mm gun and the 175mm gun, this carriage is designated the T236, T245, and T235 respectively. With wrecker kit it will be designated T119 (unarmored) and T-120 (armored). Capable of rapid occupation of position and rapid displacement, these weapons will have the increased battle area mobility and endurance which future tactics will require. It will be transportable in Phase III of airborne operations. Current towed 8-inch gun, self-propelled 155-mm gun, and self-propelled 8-inch howitzer will be replaced by this new family of heavy artillery. Compared with current self-propelled weapons of this type, this new design provides for reduction in length of about 3 feet, in width and height of about 2 feet, and in weight of 43,000 to 48,-000 pounds.

(U. S. Army)

PHYSICAL CHARACTERISTICS

	8-in How. T236	175mm gun T235	155mm Gun T245	Wrecker T119
Length	24′ 1″	*36′ 8″	29′ 10″	22′ 5″
Width	10′ 4″	10′ 4″	10′ 4″	10′ 4″
Height	9′ 1″	9′ 1″	9′ 1″	9′ 1″
Weight	57,500 lbs.	61,500 lbs.	56,500 lbs.	45,000 lbs.
Elevation (Degrees)	0 to 65	0 to 65	0 to 65	15 ton lift
Traverse (Degrees)	60	60	60	10 ton lift & swing
Crew	5	5	5	3
Ammo carried (rds)	2	2	2	—

* In travel position 4′ 4″ longer in firing position.

The Self-propelled Carriage, T195 is being developed to meet the requirement for a lightweight, self-propelled carriage for the 105mm Howitzer. Providing protection against flashburn, shell fragments and small-arms fire, and capable of rapid occupation of position and displacement, this weapon will perform the direct support missions within the armored division. It is transportable in Phase III of airborne operations. Compared with the present standard self-propelled 105mm Howitzer, M52, the T195 provides for a reduction in weight of 16,000 pounds.

(U. S. Army)

PHYSICAL CHARACTERISTICS

Length ..... 18′ 7½″	**Weight** ..... 31,300 lbs	**Elevation (Degrees)** . —10 to 75	
Width ..... 10′ 4¼″	**Weight** ..... 37,700 lbs (combat loaded)	**Traverse (Degrees)** ..	360
Height ..... 8′ 6¼″		**Crew**	5

The Self-propelled Carriage, T196 is being developed to meet the requirement for a lightweight, self-propelled carriage for the 155mm Howitzer. Providing protection against flashburn, shell fragments and small-arms fire, and capable of rapid occupation of position and displacement, this weapon will perform the general support missions within the armored division. It will be transportable in Phase III of airborne operations. Compared with the present standard self-propelled 155mm Howitzer, M44, the T196 provides for a reduction in weight of 21,000 pounds.

(U. S. Army)

PHYSICAL CHARACTERISTICS

Length ..... 18′ 7½″	**Weight** ..... 35,500 lbs	**Elevation (Degrees)** . .—5 to 75	
Width ..... 10′ 4¼″	**Weight** ..... 41,000 lbs (combat loaded)	**Traverse (Degrees)** ...	360
Height ..... 8′ 6¼″		**Crew**	5

SEEN AT THE 41ST MEETING OF THE

American Ordnance Association

1. The "MAW" is a new medium assault weapon. It is a shoulder-fired, 90mm recoilless rifle, four feet long, weighing 35 pounds. It fires a round weighing nine pounds, employing a shaped charge, and has an effective range of 500 yards, more than twice that of the "bazooka."

2. The Redeye is a new surface-to-air shoulder-fired guided missile system. It was designed to provide combat troops with the capability to destroy low-flying strafing or bombing aircraft. The system is about four feet long, three inches in diameter, and weighs 20 pounds.

3. The Army's new convertible utility ¾ton truck is an experimental dual-purpose vehicle having the characteristics of the Jeep and the Mechanical Mule.

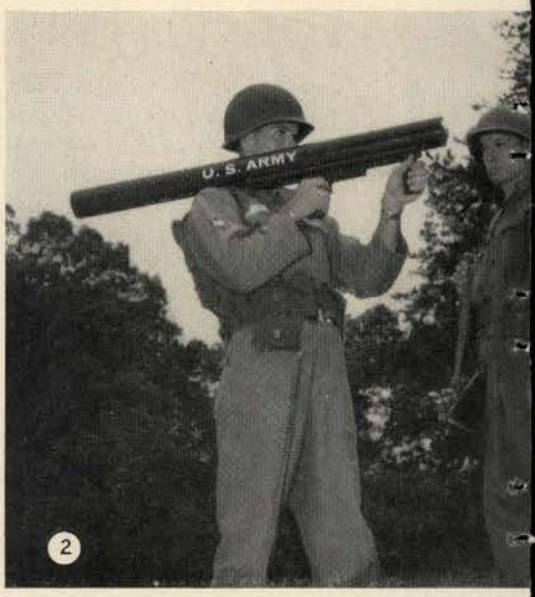
4. The XM70 is a close support artillery weapon system using the boosted rocket principle.

5. The M60 has been designated the Army's new Main Battle Tank. It mounts a British made 105mm gun and is powered by a Continental 750 horsepower diesel engine.

6. The Little John is a 14.5 foot long rocket, 12.5 inches in diameter, with a launch weight of 800 pounds. Its lightweight launchers and ground equipment are adaptable for an extremely high degree of mobility on the ground and are easily airlifted.

7. The T235 is a part of our new family of SP weapons. It is the T235 self-propelled carriage, mounting a 175mm gun. Mounting an 8-inch howitzer it is the T236. Mounting the 155mm gun it is the T245. Mounting a wrecker kit it will be designated the T119 (unarmored) and T120 (armored).

(All Photos U. S. Army)



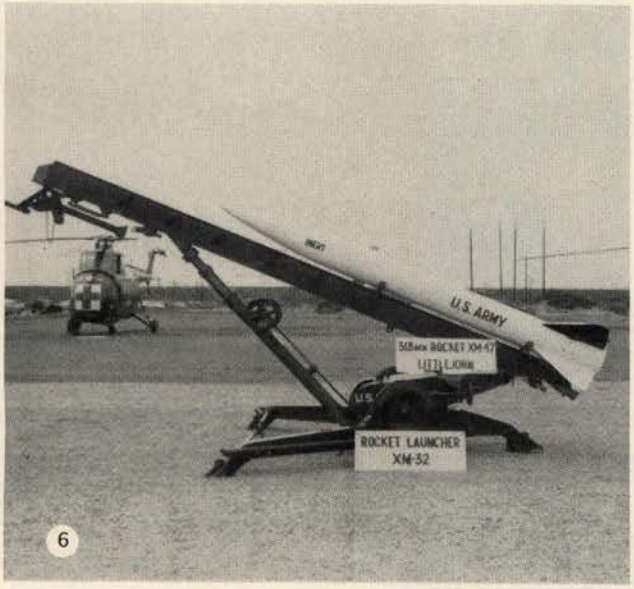
2

3

1

4

5



6

7

(U. S. Army)

Individual, Squad, Section and Platoon Testing

By CAPTAIN JOHN C. FAITH

ESSENTIALLY, armored cavalry units are "organized, equipped, and trained to perform three basic combat roles: reconnaissance, security, and economy-of-forces missions" (par 3, FM 17-35). The reconnaissance role can be divided into three normal type missions. First, armored cavalry units can perform route, zone or area reconnaissance for the purpose of acquiring and reporting information concerning the terrain, the road net, trafficability, bridge capacities and so forth. Second, and often in combination with the first type mission, armored cavalry units can find and report the enemy, his size, his location and his vulnerability as a target for whatever weapons are available, including atomic weapons. Third, these units can maintain sustained surveillance over wide areas.

Under the general role of security

The tests produce confident soldiers and small units capable of intelligent, independent

we find such normal type missions as screening the front of a larger unit, protecting a flank, covering a gap between two units, and securing rear areas, lines of communication, and installations.

The last basic role, that of economy-of-force, covers a multitude of missions, most of which result in a few broken bones and bloody noses. FM 17-35 speaks of "suitable reinforcement," but often armored cavalry units are committed **without reinforcement** and indeed, since the reconnaissance battalion contains the necessary elements of a combined arms team, it often may not require reinforcement except, perhaps, for engineers and artillery support. The type missions normally assigned under the heading of economy-of-force are attack, defense and delay missions.

Any training program developed for an armored cavalry unit must, of necessity, include instruction in all of the above missions; and any series of tests designed to evaluate the training status of such a unit must include the skills and knowledge necessary for the successful accomplishment of its three basic roles. This article covers individual, squad/section, and platoon tests, the basis for an effective Battalion and Regiment.

The Problem of Space

Before describing the tests themselves, we should look briefly at one over-riding and continuous problem faced by everyone who has the responsibility for testing an armored unit, especially an armored cavalry unit: the problem of space. No major training area in Western Europe has the physical dimensions required for a realistic test of a reconnaissance battalion. Beyond the boundaries of the training area, maneuver restrictions and maneuver damage affect the realism and add immeasurably to the expense of conducting any test.

The 14th Armored Cavalry has as its major training area Wildflecken,

CAPTAIN JOHN C. FAITH, Armor, a 1947 USMA graduate, first served with the 15th Constabulary Squadron in Germany. In 1952 he returned Stateside and attended the Armor Advance Class. Next he was an English instructor at West Point. Returning to Germany in 1956 he served in various capacities with the 14th ACR. He is now attending C&GSC at Fort Leavenworth, Kansas.

located in the pine covered hills southeast of Fulda. An area with a past, Wildflecken was used to train German ski and SS troops early in World War II. It is said that the installation was so well camouflaged that American troops had difficulty finding it even after being told of its existence. All Americans who have trained at Wildflecken agree that it is unique. Wildflecken is the first area blanketed by snow in the fall and the last to lose its last dirty white patch in the late spring every year. Its 15 square miles of precipitous rock and tree covered slopes, surprisingly well bound together by deep and cantankerous mud, are hardly what could be called ideal tank country; but they have had the back-hand positive effect of convincing the troopers of the 14th that they can go anywhere.

Wildflecken serves as the battleground for our mortar squad and platoon tests. The individual proficiency and other section tests are normally conducted at the home stations of our three battalions.

Testing Principles

We have developed over a period of time, and as a result of the work of many fine soldiers, a set of testing principles which we believe to be valid and widely applicable. To understand the purpose and value of our testing procedure, it is first necessary to understand these principles:

1. The tests are designed primarily as a training vehicle. With the space, time and fiscal limitations of today, our field training time is both precious and critical. We cannot afford to lose the training value of any single exercise. This fact is especially important when we consider that each time one of our units moves out on a test, some of the troopers are going to the field as members of the Regiment for the first time.
2. Each test is designed to reinforce and re-emphasize the key teaching points of the tests which have preceded it. The discussion above, as well as good pedagogic techniques, provide the reasons for this principle.
3. While including the important skills and knowledge of previous tests, each successive test incorporates these points in a larger framework, and puts increasing emphasis on troop leading procedures and the coordination of small units in an ever larger "big picture."
4. Each test is written as if the next larger unit of which the tested unit is a part were physically present, though no participation of the larger unit is necessary except for a CP group to receive reports and act on requests of the tested unit.
5. Each test is designed to evaluate the unit in the skills and knowledge required for its logical and foreseeable combat employment.
6. Each test is designed to include the valuable training resulting from the time honored procedure of "fall out one."

Having examined briefly the main principles which guide the preparation and conduct of our tests, let us look at the tests themselves. The place to begin, as the King of Hearts in *Alice in Wonderland* logically suggested, is at the beginning.

Individual Proficiency Tests

The basic guide for the training of the individual soldier in the Seventh U. S. Army is Training Circular 20-1, which establishes a list of some 25 mandatory subjects in which the in-

action. They may be the life saving and war winning capability in any future conflict.

dividual soldier must be proficient. Though the circular does not specify minimum or required hours, it does establish standards of proficiency; and these standards furnish the necessary guidance for the preparation of our individual proficiency tests. We use essentially two types of tests: written and practical. Most of the skills and knowledge we are evaluating require performance rather than written answers, thus, most of our individual proficiency tests are practical tests, organized usually along "county fair" lines. The advantages of the "county fair" system are numerous: we can test a large number of individuals on several subjects in a short time, using our experts to run the various stations; we are able to introduce the element of competition, which spurs our soldiers to their best efforts; the system requires little preliminary work other than a few signs and the preparation of the individual stations; the results are immediately available for recording and to help us analyze weaknesses in our formal instruction; and we can achieve maximum participation, a difficult problem when the tests are run piecemeal in the individual companies.

The majority of these tests are conducted near the end of the first phase of the training year, though some of the written examinations are given immediately following the formal instruction. Such subjects as graves registration, code of conduct and military justice require a written examination, whereas demolitions, mine warfare, first aid and handling of prisoners of war, to name a few, are best tested with a practical exercise. A few subjects require both types of test: map reading, CBR and intelligence, for example. Once an individual has demonstrated the required proficiency in any of the mandatory subjects, he may be excused from further classroom instruction except, perhaps, as an instructor or assistant instructor. He is not allowed to forget, however, for training in mandatory subjects is integrated in all field work.

Squad and Section Tests

The conclusion of our second major phase of training is marked by the next step in our evaluation procedure: squad and section tests. Each of these tests is normally divided into a written portion and a practical portion. The written portion is designed to remind each individual that his personal knowledge of the capabilities, limitations and techniques of his squad or section, as well as his knowledge of subjects he learned back in the individual phase of the training year, are fundamentally important to the success of his unit. The practical portion of the test places the squad or section in a tactical situation with its TOE equipment and, while aimed primarily at evaluating the basic skills of the tested unit, it begins to place emphasis on troop leading procedures and on the functioning of the unit as a team.

(U. S. Army)

Two soldiers at Map Reading station of the "County Fair" individual testing.

Our scout section tests are conducted at home station, as previously mentioned, because of the limited time available at Wildflecken and to give us a pool of wily and effective aggressors for the other tests. For each test we require a full TOE squad or section, a requirement which has two important purposes: *First,* it gives the unit leader his full capability with which to meet the requirements of the test. *Second,* it establishes the necessity for a certain amount of cross-training of personnel, a valuable asset in a reconnaissance unit where every vehicle, radio and crew-served weapon is of critical importance. It is obvious that there are many possible variations of these tests and that the tests we use are far from all-inclusive. None of the tests lasts longer than 12 to 14 hours, and complete evaluation is impossible in such a short period of time. However, we believe that they provide sufficient indication of the state of training of the squads and sections to give intelligent guidance for the continued training of these units in the platoon training period which follows.

Scout Section Test. The written portion of the scout section test emphasizes the following subjects: organization and equipment of the section, including duties of the personnel, operating characteristics of the equipment, and basic loads; typical scout missions; map reading; artillery adjustment; reporting information; and handling of prisoners of war.

The practical portion of the test begins with an oral platoon leader's order which establishes the tactical framework of the rest of the test. The section is scored on its preparation for the mission, a detailed inspection of its equipment and personnel, zone reconnaissance, counter-reconnaissance screen, delay, manning of observation posts and listening posts and passage of friendly lines. The successive phases of the test are forced by controlled Aggressor action or are directed by fragmentary oral orders.

Tank Section Test. The written portion of the tank section test includes

(U. S. Army)

An AR team is shown establishing a defensive position during the squad test.

both technical and tactical questions. Emphasis is on organization and equipment of the section, covering the same type questions as the scout test; range cards; technique of fire; crew drill; map reading; and positioning and moving tanks in contact with the enemy.

The practical test begins with pre combat checks and a detailed inspec tion. Following the inspection the tank section is briefed on a tactical situation, moves to a delaying position, executes a delaying action, receives a change of mission and moves out to secure a road junction. On the way it encounters a broken down enemy vehicle with crew and takes the necessary action. The section then attacks and secures the road junction, organizes a road block and defends the junction against Aggressor action. While in this position the crews perform crew drill including evacuation of one of the tanks and preparation by its crew to fight as infantry.

Infantry Squad Test. The written portion of the infantry squad test emphasizes organization and equipment of the squad, as in the previous tests; demolitions; formations, including the tactical considerations involved in the choice of formations; organization of ground and use of mines.

The practical portion of the test places the squad, as part of a reconnaissance platoon, in an attack situation from which are developed the various specific missions on which the squad is tested. The test begins with normal preparations for action, precombat checks and inspection of personnel and equipment. The squad moves out and soon receives an order to reduce a road block which is holding up the platoon's advance. After the reduction of the road block, the squad moves into an attack position, receives an attack order, moves out as the maneuvering force in an attack and secures its assigned portion of the objective. The squad repulses a counterattack and continues to organize the objective to defend it. The organization of the ground includes, in addition to emplacing the crew-served weapons, the laying of a hasty minefield. The last requirement, as night falls, is a combat patrol with the mission of obtaining information about the enemy and, if possible, bringing back a prisoner.

Mortar Squad Test. The mortar squad is examined, in both the written and practical tests, on the tactical and technical details of firing the mortar effectively under combat conditions. The written test emphasizes organization and equipment of the squad, map reading, selection of observation posts and details of the mortar. The practical test begins, as did the previous tests, with preparation for combat and a detailed inspection. Following the inspection the squad receives a tactical order, moves into position and takes various targets under fire, including point, area and traverse and search type targets. The squad leader is used as the forward observer and is graded on his sensings and commands. The remainder of the squad is graded on techniques of firing the mortar and teamwork. This test is the only one which is made up primarily of live firing.

In each of the above tests, all members of the squad or section are required to take the written examination, and the average grade determines the score the section receives. The written portion of the test is worth from one-fourth to one-third of the final grade. Tests vary among the battalions, but most of them follow the general pattern outlined above. Each test is, of course, followed by a thorough critique.

Platoon Tests

At the conclusion of the squad and section training phase of the training year, and shortly before the company and battalion tests, our units return to Wildflecken. By this time the weather and the training area are usually almost agreeable, and only a few well-known spots remain in which a vehicle can sink out of sight in a matter of minutes. Our platoons are ready and eager to roll; and though the reservation is small, we spend several weeks battling back and forth across it, raising tremendous dust clouds as we look for new ways to attack and defend hills 807, 924, 910 and 838.

Reconnaissance Platoon Test. The reconnaissance platoon test, which lasts approximately 24 hours, begins with the briefing of the platoon leader in the early afternoon, followed by his order to his platoon, preparations and precombat checks and limited reconnaissance. The platoon is alerted, inspected and questioned in the early evening, and just before dark moves out on a black-out road march of approximately 15 miles, closing into an assembly area late in the evening. Security is established and the platoon settles down to a night of harassment and attempted infiltration of its position. Shortly before dawn the platoon is alerted, and

moves to a delaying position where it establishes a counter-reconnaissance screen and strong point. Aggressor, a reinforced tank platoon, appears shortly on the scene, with the mission of seizing a series of objectives which just happen to lie in the assigned sector of the reconnaissance platoon. The reconnaissance platoon reports the movements of Aggressor and takes him under fire at maximum range with tank and artillery fire. Forced to withdraw, the platoon executes maximum delay in sector on a series of phase lines and intermediate positions, breaks contact, passes through friendly lines and moves into an assembly area.

At this time the platoon receives a new mission. A series of friendly atomic weapons have been fired (requiring protective measures by the platoon), and Aggressor has broken contact. The reconnaissance platoon is ordered to execute a zone reconnaissance, moving forward in sector until enemy contact is regained. The platoon moves out, and after a zone reconnaissance of roughly ten miles, during which SOP reconnaissance reports are submitted, encounters Aggressor in strength in a defensive position. A coordinated attack is ordered by the company commander and launched by the reconnaissance platoon. Upon seizure of the objective, the platoon is ordered to reorganize and hold the position and, after beating off a brief counterattack, is declared either victorious or dead.

A critique is held immediately, followed by analysis of the various umpire check sheets and a more detailed critique later in the day.

Throughout the test the emphasis is on troop leading procedures, coordination of the sections, rapid response to orders and operational techniques. Umpires are assigned to each squad and section, in addition to the chief umpire, who accompanies the platoon leader. The Aggressor is absolutely unrehearsed and is, in fact, being tested himself. Let us now look at the tank platoon test which the reader will recognize as the other side of the test outlined above.

Tank Platoon Test. The tank platoon test also begins with a briefing of the platoon leader in the early afternoon, and the test parallels that of the reconnaissance platoon through the movement after dark into an assembly area and the inevitable harassment during the night. Here the parallel ceases. Several hours before dawn the platoon is reinforced with an armored infantry platoon and the necessary coordination is effected, including the issuing of an attack order by the tank platoon leader. Shortly before dawn the platoon team is alerted and moves into an attack position from which, on order, it crosses the line of departure in an attack on a series of objectives to protect the flank of a larger force.

After the initial order, all control and changes of plan are accomplished by fragmentary orders over the radio and by visual signals, for the situation moves rapidly during the attack. The team is permitted little time to organize any of its objectives completely. An aggressive platoon leader receives almost immediate permission to continue the attack once he has consolidated each objective, and a cautious platoon leader is prodded by his company commander (umpire), based on the simulated flank situation, to move rapidly. Thus, pressure is maintained on the delaying force, and the initiative and ingenuity of the tank platoon leader are given a thorough workout.

As the team begins consolidating its final objective, action is interrupted by the previously mentioned series of atomic bursts and the platoon leader receives a fragmentary order to withdraw, move back some five to ten miles, and establish a hasty defensive position on an assigned hill. Once established in the new position, the platoon leader is given an oral defense order and told to establish a strong point in his present location and to prepare to defend the position. Some time later the position is hit by the reconnaissance platoon (which is given a simulated strength sufficient to take the position). The tank-infantry team is forced off the position and shortly thereafter counter-attacks with one tank section to test the defenses of the reconnaissance platoon.

As with the reconnaissance platoon test, one critique is held immediately after the test, and a second, more detailed critique follows after analysis of the umpires' check sheets. And also, as with the reconnaissance platoon test, the emphasis throughout the test is on troop leading procedures, rapid reactions and operational techniques.

(U. S. Army)

Part of a reconnaissance platoon moves into its attack position during tests.

Conclusion

We do not claim infallibility for the tests outlined above, nor do we believe that they are at present in their best or final form. They undergo constant review and will continue to be the result of an evolutionary process which incorporates the ideas of many men. We do believe that they produce confident soldiers, and small units capable of intelligent, independent action—and this may well be the life saving and war winning capability in any future combat operation.

(U. S. Army)

A Standard Emergency Task Force

By COLONEL JOHN K. BOLES, JR. and LIEUTENANT COLONEL JACOB R. DEGENHARDT

A CURRENT need exists for a highly mobile, hard-hitting, emergency task force to meet and halt enemy penetrations anywhere, anytime in the Division zone, within 30 minutes.

It is also a fact that dispersion is a primary requirement due to Aggressor possession of nuclear weapons and his willingness to use them. This dispersion causes an unacceptable reaction time in conventional forces.

We must develop a Standard Emergency Task Force now! We have the vehicles, we have the hardware. Let's go!

Explanation

There have been quite a few articles written lately on the forecast of future events and what the Pentomic Army is to have in the way of hardware. A fertile imagination is a wonderful thing to have and thank goodness we have some in the Pentagon. In the meantime, the U. S. Army soldier of today is faced with hard facts—he must solve the problem or die. This is our solution—a new and different one—murder boarded by some pretty hardheaded professionals, and what's most important—*we can have this unit in six months or a year—ready to fight.* The material is on hand now or can be very shortly; the mission can be accomplished day or night, and all of it in approximately 30 minutes. One thing must be remembered—this is not Korea, and Aggressor is mechanized, armored and highly mobile. The standard emergency task force we need now is a Sky Cav Rocket Troop.

The troop is basically a helicopter-borne cavalry troop. It is applicable to any division in any theater of war; it can be employed either in the of-

COLONEL JOHN K. BOLES, JR., Armor, a 1939 USMA graduate, served in Europe during World War II with the 3d Armored Division. Attending C&GSC in 1949 he stayed there as an instructor to 1954. Graduating from the Army War College he commanded the 6th ACR in Germany until 1957. Next he was G3, VII Corps. Returning Stateside in 1959 he is the Senior Military Advisor from R&D, D/A to the Operations Research Office.

LIEUTENANT COLONEL J. R. DEGENHARDT, Armor, served in Europe during World War II with the 1st T.D. Group. He served in JUSMAG, China during 1947-48 and in Korea to 1951 where he commanded ASA. Next he attended the U. S. Army Armor School remaining as an instructor to 1955. Attending C&GSC he was Advisor with the New Jersey National Guard prior to assignment as Commander, MAAG Liaison Team, Germany.

fense or defense, in small wars or big ones, is particularly adapted to mobile defense, and can fight day or night and in periods of varying visibility. The troop is composed of a Command Section, a Forward Observer, a Forward Air Controller, a Reconnaissance Platoon, an Illuminating Section, a Support Section and two Weapons Platoons. All personnel are mounted in helicopters.

COMMAND SECTION—The Troop Commander rides in a command helicopter equipped with TV receiver, radio communications with the Troop Commander, and to his own people.

RECONNAISSANCE PLATOON—The Recon Platoon consists of three helicopters, two TV transmitter drones, and operating personnel. The platoon is completely mobile. The helicopters carry colored smoke rockets and colored flares for indicating targets day or night, and in addition, have TV transmitters and outside-mounted radiac instruments. The drones, also equipped with radiac devices, are carried by and launched from helicopters. We have the drones now and late reports indicate we also have the choppers to do this job.

(U. S. Army)

An H13 reconnaissance helicopter carrying two SS10 guided antitank missiles.

and with radio to his Division Headquarters as well as to his subordinate units. The helicopter is equipped with smoke rockets for indicating targets up to 4,000 yards.

The Artillery Forward Observer flies a helicopter fully equipped with radio, and smoke rockets, and he spots for Division Artillery.

The Forward Air Controller, in a helicopter also, has eight large colored smoke rockets to mark targets so that even the Air Force close-support jet planes can spot the target. He has

ILLUMINATING SECTION—This section contributes the major part of the troop's night capability. Each of the two choppers carries eight five-minute rocket parachute flares. Range of rocket flare is 4,000 yards.

WEAPONS PLATOONS—Each of the two weapons platoons has five helicopters. Each helicopter mounts eight of the SS10 or 11 type rockets (six antitank and two antipersonnel) with a range of 3000 yards. Here is a small unit with a big wallop.

SUPPORT SECTION—Here is your big punch in a neat package with currently available hardware. The section consists of two heavy helicopters, each one carrying a Demi-John or small 2-KT nuclear rocket (modified Sidewinder or Falcon). The choppers have a simple range finder coupled to a time-fuze-setting device in the rocket. The gunner ranges in on the target, and the fuze is automatically set to detonate the rocket in the air above the target. A simple stadia-type sight will permit the gunner to get an habitual height of burst of approximately 300 feet. Each helicopter is equipped with suitable radios.

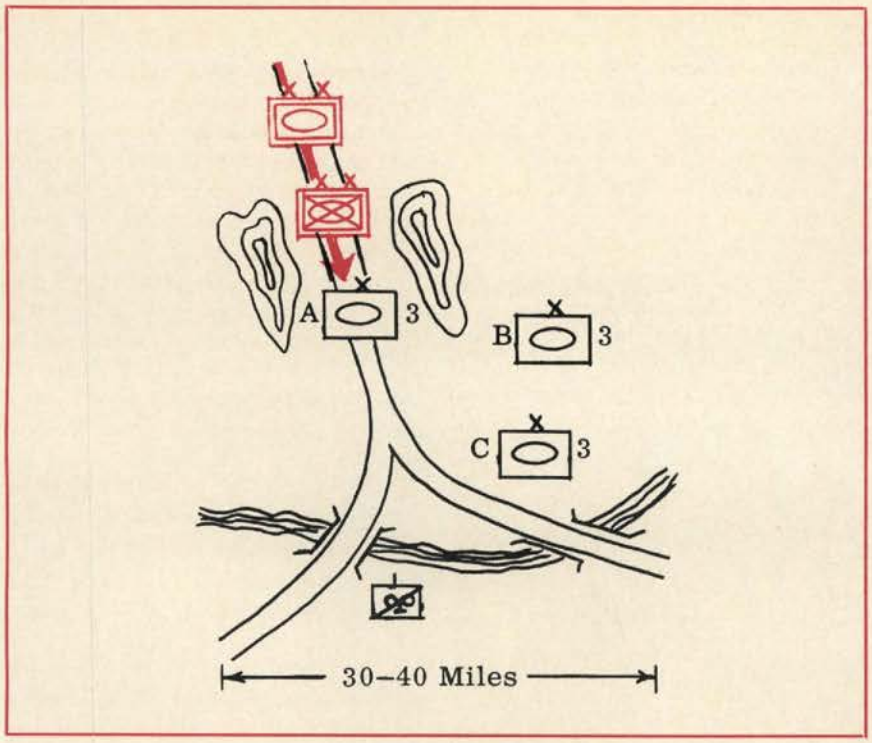
RECAPITULATION—The Sky Cav Rocket Troop totals 20 helicopters, two drones, 21 radios, and approximately 70 officers and EM to include pilots, mechanics and administrative and supply personnel. It is a small but powerful unit.

Concept of Operation

SITUATION—Our Armored Division is operating on a 30- to 40-mile front with two combat commands in contact, and the third combat command in division reserve as the division striking force. In this situation, the Striking Force might be 10 to 15 miles from the scene of trouble. Time is a major factor when you begin to add up the time it takes to realize that a critical situation exists, to formulate a plan of action and issue orders, and to move the force. Then add a quick reconnaissance, the concentration of units into attack formation, and the attack itself, and *time* is of the very essence. Two to three hours have passed. At night, it would take even longer.

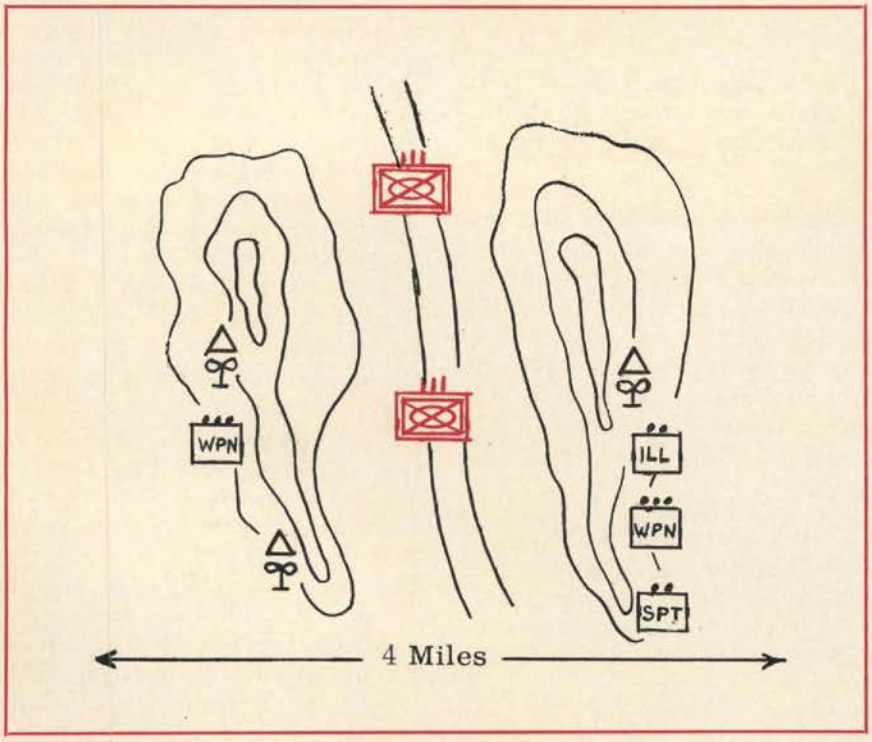
THE ENEMY—An Aggressor Mechanized Division backed up by a Tank Division is in contact. Reconnaissance in force is evident and indicates a big push. Aggressor drops a 50-KT weapon and attacks. *How much time do you have now?*

CONCEPT—The Sky Cav Rocket Troop, in division reserve, sees the flash, hears the explosion, and automatically sends out the Recon Platoon to determine location, strength, composition of the enemy and the radiation in the area. Two fast drones are launched over the area from the airborne Recon Platoon; factual in-



Situation

formation comes quickly, and the TV picture is transmitted to the Troop Commander and the Division CG simultaneously. Our CCA is hard hit; Aggressor is pushing. CCA has been unable to inform Division Headquarters due to the effect of the 50-KT weapon. The CG orders the Sky Cav Rocket Troop into action and then orders his reserve combat command to counterattack. Time elapsed—15 minutes.



Employment

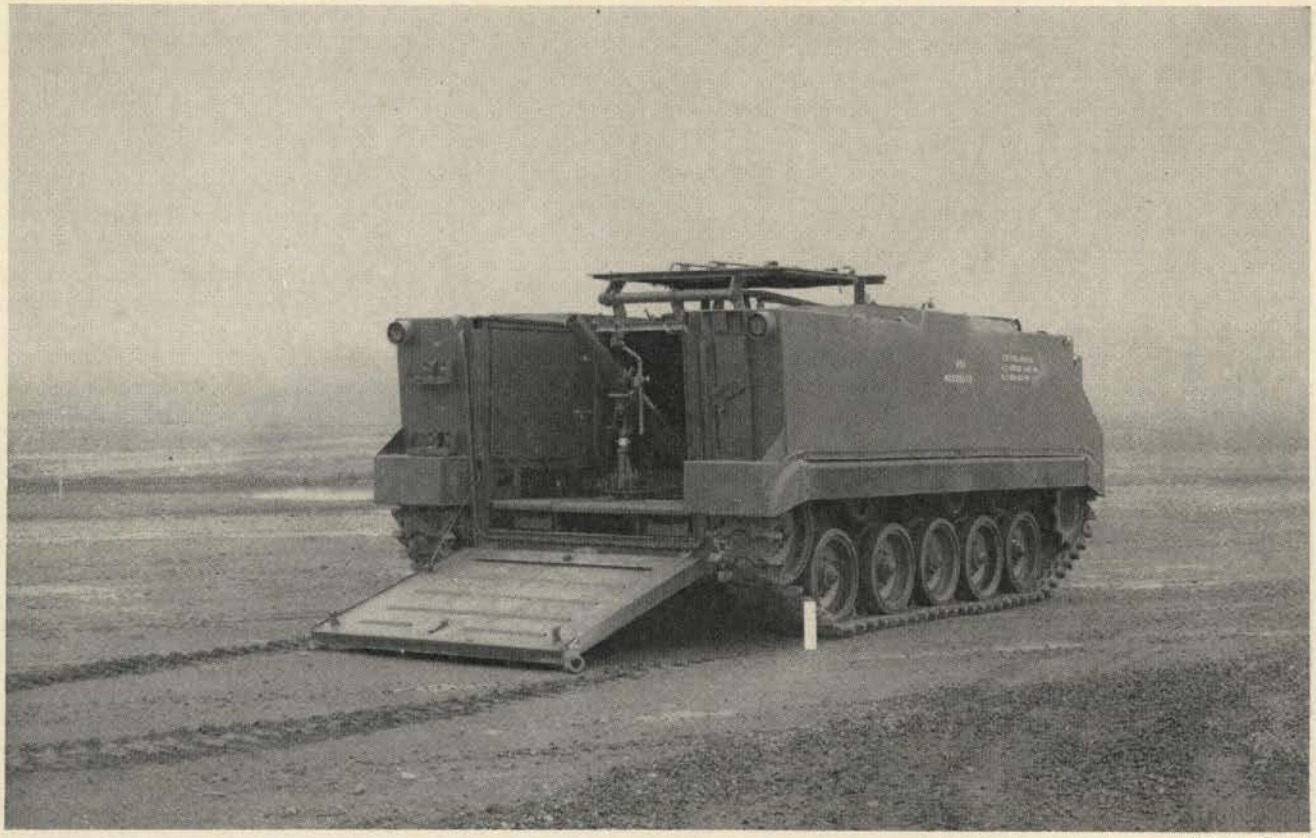
The Rocket Troop is airborne and moving in a few minutes. Masking hills are utilized to conceal the advance—hill defilade is valuable. If it is night, the illuminating section would go forward and fire their rocket flares over the general trouble area. The Reconnaissance Platoon choppers move in, quickly locate the major enemy unit, and mark it with smoke. This also cuts down enemy visibility as well as aids target identification.

Now the Support Section is ordered in. The first chopper ranges in on the big target as he advances, fires and promptly bobs down behind the hill to take cover from the 2-KT shot. Immediately after the first shot goes off, the second chopper goes up, ranges, and fires, and he too ducks behind cover. The result should be considerable damage and confusion in the enemy regiment, maybe ten tanks destroyed plus thin skins, many more tanks disabled, and vehicles on fire, vision blocks and sights frosted, radios out of action, and the tank commanders and other exposed personnel casualties. But our job is only half done!

And now—here come the SS Weapons Platoons, charging in from both sides and firing their powerful rockets. Ten choppers with eight rockets each is a total of 80 and a lot of individually directed firepower concentrated on a bunch of sitting ducks. That is exactly what you and I want and must have.

By the time the troop basic load is expended, the attack is stopped and broken up. The FAC is calling for Tactical Air, the airborne FO is calling for artillery, and only 30 minutes has elapsed since the enemy 50-KT weapon was fired. The mission is accomplished. In another hour or so we know the Armored Striking Force will arrive and exploit the damage caused by our standard emergency task force the Sky Cav Rocket Troop. All the fancy rockets and nuclear weapons in the world will not serve the man in contact with the enemy if he can't fire them where and when he wants. A Corporal or an Honest John or a Lacrosse is far from being instantly responsive to the demands of the front-line battalion or battle group.

We *want* this Sky Cav Rocket Troop and *must* have have it. We *can* have it—So let's *get* it!



(U. S. Army)

The Mortar and Navigation

By SECOND LIEUTENANT JAMES W. OWEN

THE marriage of the Armored Personnel Carrier and the 4.2 inch mortar is a great advance in providing artillery capabilities for front line infantry troops. This mating gives three important capabilities to the 4.2 inch mortar.

1. Mobility to support a fast moving Pentomic Army.
2. Mobility as a defense to counter mortar fire.
3. A type of mobility which allows firing as soon as the APC stops. The true value of this combination can only be shown under actual battlefield conditions.

There is a limitation which must be placed on the third capability of this combination. It is certainly true that the 4.2 inch mortar could be fired as soon as the APC stops except for the fact that the mortar must first be aimed. There are four ways which a mortar crew could use to establish direction and range of a target:

1. Conventional surveying.
2. Line of sight to target.
3. Resection on a map.
4. The Vehicle Direction and Position Indicator System.

The conventional method of surveying into an area establishes a base line, from which to determine the direction of fire, and the location of the firing position. Though this method is the best, for accuracy, it is also the slowest. This method then greatly decreases the mobility provided by the marriage of the 4.2 inch mortar and the APC.

The most obvious method of aiming the 4.2 inch mortar would then be by line of sight. This method has two disadvantages. *First,* one must have a line of sight to a target. This of course works both ways. If you can see them, then they can see you and return fire. *Second,* the maximum range of the 4.2 inch mortar is 6,000 yards, and only under the best conditions could the line of sight aiming allow full use of this range.

Resection by use of a map requires not only identifiable objects on which to sight but it requires time. If there is good cover, it is even harder to use resection as a method of determin-

SECOND LIEUTENANT JAMES W. OWEN, Corps of Engineers, received his BS degree from the Missouri School of Mines and Metallurgy in 1958. After attending the Engineer Officer Basic Course he was assigned to the Mine Detection Branch, U. S. Army Engineer Research and Development Laboratories. He is Assistant Platoon Leader, 100th Engineer Company, Fort Belvoir.

ing location and establishing direction of fire.

Resection, surveying and line of sight are all limited by weather and light conditions. Firing by line of sight is the quickest of the first three methods and takes less than a minute. Resection would take about five minutes, surveying is dependent upon the distance from the control and would take three men a minimum of 30 minutes per mile.

The United States Army Engineer Research and Development Laboratories (USAERDL) recently ordered Vehicle Direction and Position Indicators (VDPI) for User Test scheduled for early 1960. These units will tell where a vehicle is at all times, under all conditions. In addition the VDPI can tell the direction and range to any desired target as quickly as the grid coordinates can be dialed into the computer. Thus, it would be possible to be driving along when a request for fire is received and by dialing in the target one can tell if it is within range. If the target is within range it is not even necessary to travel any further or even to consult a map. All that is necessary is to stop, aim by the use of the computer, and fire. Needless to say the entire operation would take less than 30 seconds. By use of this system alone an APC could be driven ten miles, stopped, the mortar would fire and place the first round in an area about the size of a city block at a range of 6,000 yards. It would then be possible to adjust the fire onto a point target.

The accuracy is not as good as we would prefer, but this disadvantage is far overshadowed by the ease and speed of operation. The advantage of being able to fire so quickly by far outweighs this size of an error. Because the mortar crew knows their location within 300 to 400 feet it is possible to make small adjustments, by comparing the terrain and map features, for a better adjustment of fire. The VDPI is yet to prove its value as an aid to the Infantry but its reliability has already been proven by laboratory and field test. Final production models of the VDPI will probably have more accuracy than the engineering test model on which this article is based.

Use of the VDPI system with the 4.2 inch mortar and the APC would allow a combat unit to take advantage of all its fire capability at any time. It would not be necessary to divide a unit's 4.2 inch mortars into two fire teams, with one team firing while the second team moved into a new location. Now it is possible to double the advancing speed by eliminating the need for *leapfrogging* units. Even if it were still desirable to *leapfrog*, then the unit on the move could stop at any time and provide full fire support in seconds.

A closer look at the VDPI shows it is made of three units:

1. Odometer which provides distance data.
2. Gyro Compass which provides direction data and
3. Computer which takes the odometer and compass data and displays any change in vehicle position automatically regardless of the route taken.

There are also provisions made for two attachments to the VDPI. They are: a plotting board, to show on a map or graph paper the position and route taken and a telemeter to broadcast the present position of the vehicle carrying the VDPI. The telemeter could be used to give a tactical commander constant up to the second information on the location of his units. This would provide a commander with the ability for complete control.

There are many other possible uses for the VDPI which are yet to be shown by the User Test. Just where the VDPI will fit into the Army of 1965 is yet to be determined. As with most items the cost of the VDPI and its value to a modern mobile Army must be balanced.

(U. S. Army)

Model of Vehicle Direction and Position Indicator, which was tested at Fort Knox.

TANKS?

By MAJOR W. C. BARRETT

A CURRENT and recurring question in Marine Corps tactics and techniques is the place of tanks in the concept of future warfare.

What shall we do with the tank? Shall the tank be abandoned as a weapon? Should tanks be pooled at higher echelon? How should Marine Corps tanks be organized? Is the present medium tank the best combat vehicle for future amphibious warfare? These and other questions surround the Marine Corps tank, creating an unhealthy air of uncertainty.

The significant question is the essential importance of the tank in an amphibious assault doctrine geared to the highly mobile demands of tactical nuclear warfare. In fact—for now, and the immediate future—it is required. Atomic-threat battlefields can serve as the stage upon which the tank—or some tank-like vehicle—will perform its finest role.

Our mission as Marines presupposes a striking force capable of violent assault action and strong staying power under nuclear or non-nuclear conditions. The qualities that provide these are accurate, destructive firepower, mobility, shock action and armor protection.

Tanks, since they combine heavy armor with a mobile weapons system, are ideal offensive weapons. Their mobility, flexibility, armored firepower and shock effect give to warfare a combination of speed and violence difficult to equal. Tanks, when properly supported, possess tremendous staying power. Speed, staying power, and the violence that they impart to combat have, in the past, made tanks invaluable in amphibious operations. The value of tanks in future amphibious operations will be enhanced by the nature of the future battlefield.

Tanks are required for tactical atomic warfare. Battlefield mobility, protection, highly effective firepower, reconnaissance capabilities, ease of control and rapid reaction time are tank characteristics.

Tactical mobility is the key to success on the dispersed battlefield. Inherent mobility and relatively high battlefield speed enable tanks to mass rapidly for penetration of enemy formations or exploitation of friendly atomic fires. Tanks can quickly resume a posture of passive defense by separating. Further, rapidly moving tank formations provide difficult targets for the enemy to destroy, or even find.

As for protection on the future battlefield, the tank provides its crew with some immunity from the effects of nuclear explosion, as well as from conventional munitions. It assures them protection against certain effects of nuclear explosions which would be lethal to others. This enables the tank to lean into friendly nuclear fires, poised for rapid exploitation, while, at the same time, enjoying protection from enemy nuclear attack.

Unit separation creates a wide open battle area in which finding targets and developing intelligence is difficult. Constant deep reconnaissance by units strong enough to operate independently against enemy armored screening forces is required. Tanks are indispensable in this phase of warfare—as they are in counter-reconnaissance and screening friendly battle areas. The tasks of screening and counter-reconnaissance will be monumental on a thinly-populated, fluid battlefield. Brief, violent engagements will occur; rapid, violent reaction is a prerequisite, and this the tank can provide.

As a result of an extensive radio communications system, tanks are easy to control. Reaction to command is immediate and the inherent mobility, armor and firepower enable the tank or tank units to counter enemy actions rapidly and violently.

From what has been said it should be allowed that the tank (or some similar type armored combat vehicle weapons system) has a place on the future battlefield, nuclear included. Let us then state its future mission, and list some of its tasks to fulfill that mission.

The mission of Marine Corps tanks will remain the same. Tanks, along with other combat and combat support elements of the amphibious landing force, perform their mission when, by armored firepower and maneuver, they close with and destroy enemy forces, fortifications, and materials.

In fulfilling their over-all mission, tanks will be found in one of four roles:

1. direct support of infantry;
2. defeat of enemy armor;
3. limited independent operation;
4. supplementing artillery fire.

Tanks are well-suited for many tasks. A partial list would include deep penetration to effect link-up; rapid exploitation of nuclear weapons; armored battlefield surveillance; reconnaissance and counter-reconaissance; counter attack; mobile defense; crossing contaminated areas as an exploitation force or as monitors. Other specific tasks for tanks in either atomic or non-atomic combat certainly suggest themselves to you.

Should (as we hope) the threat of nuclear devastation deter "all out" wars, there is no doubt as to the advantages of tanks in conventional, small-war operations which are so much a Marine Corps specialty. History testifies as to its battlefield ability. In the peripheral "brushfire" war, where terrain permits, the tank is an essential weapon. Its power will greatly enhance the swift, decisive conclusion of such wars. In these conflicts, firepower and shock action are paramount. Awesome these characteristics are, and they produce terrifying psychological effects on dissident populaces and irregular forces common to this type operation. Tanks used in a reasonable number to back up small, mobile landing forces, were vital in Lebanon—a poor tank area. They can do even better.

We cannot ignore the limitations attending the use of tanks in any type operation. Much is made of these limitations—too much perhaps. Trained crewmen can live with, and learn to minimize noise, poor visibility, weight and bulk. But there are other factors which actually impose operational limitations: the tank is sensitive to terrain and weather conditions; it presents a considerable logistics burden. The latter is most apparent in amphibious operations.

Large quantities of supplies are consumed by tanks in any operation; maintenance demands are always high. In amphibious operations, the problem is further complicated by:

MAJOR W. C. BARRETT, was commissioned in the U. S. Marine Corps in 1945. He first served with Marine Corps Armor in 1950 with the 1st Tank Battalion, 1st Marine Division. Attending the U. S. Army Armor School, he returned to the same tank battalion which was then in Korea. After several intervening assignments he returned to Armor with the 3d Tank Battalion, 3d Marine Division. He is presently stationed in New Orleans.

1. possible unavailability or shortage of assault shipping to land tanks;

2. difficulty of furnishing early re-supply by air or surface when the build-up ashore is sensitive and critical;

3. lack of maintenance facilities.

In determining whether we should or should not abandon the tank as a weapon, limitations must be weighed against advantages on the battlefield. The need for a particular weapon is seldom determined solely by logistical considerations. The infantryman's rations constitute a tremendous supply problem but we need him.

Actually, we develop the hardware to fight with by considering many factors: mission, objective, and enemy tactics and techniques are a few. If there is a need for a certain weapon —like tanks—for rapid, efficient conclusion of a mission, logistic considerations seldom preclude the use of that weapon. Considering the mission and objectives of the Marine Corps, and the probable enemy tactics and techniques, it is apparent that the tank is a prerequisite in the Corps' arsenal.

What then of tanks? We need them—even with their logistics burden. In the foreseeable future they cannot be done away with. But perhaps the existing models require design changes to better suit the needs of the Marine Corps.

The Marine Corps needs a vehicle to combat tanks, reconnoiter in force and, above all, afford maximum support of the infantry in the attack.

The principal role of Marine tanks is the direct support of infantry; this must be the dominant consideration in the design of a tank to meet Marine Corps needs. Therefore, it follows that a primary need is an assault gun to destroy strong battlefield fortifications and cause casualties. As additional armament, machine guns are needed for anti-personnel use. The main armament must possess penetrative power to defeat armor of any known tank to fulfill the anti-mechanized role. The armament must afford close-in protection against enemy personnel bent on tank-killer missions. We need a highly responsive, simple, easy to operate and maintain, fire control system such as the ranging machine gun or spotting rifle.

For close combat and assault missions the vehicle must have all-around armor protection. The weight and configuration of the armor should provide absolute protection against all weapons including the maximum density direct-fire weapon we may find on the front of our potential enemies.

Any increase in the strategic and battlefield mobility of the vehicles would of course be welcome. These could result from the reduction in size and weight of armor, as well as from future technological developments in armament and automotive components.

Automotively, the vehicles should afford greater range on less fuel, and considerably less maintenance. The complexity of the automotive equipment must be reduced to allow unskilled mechanics with detached tank units to keep the maximum number of tanks operative.

The Marine Corps needs an austere tank to perform its missions efficiently without sophisticated, vulnerable gadgetry and without unnecessary refinement. These characteristics are within present technological and production capabilities; they are wholly compatible with the "users" requirements within the U. S. Army. The latter is important since the Army is charged with the development and procurement of tanks. It behooves the Marine Corps to influence the Army's future tank development so that we obtain a satisfactory armored combat vehicle for the conduct of modern amphibious warfare.

Tank organization within the FMF deserves discussion. For some time now, tank organization has been an enigma. Present tank organization does not supply the combat power to support a Fleet Marine Force of three divisions, each with three regiments plus a service area. This inadequacy is magnified by unit separation, a concept which allocates combat means to each separate task groupment.

Assuming that division- and corps-size operations will occur in the future, it is conceivable that at least one company would be needed to support each separated regiment in addition to one company for support of the service area. An engaged division should have a tank reserve for exploitation and to serve as a mobile antitank defense. A five-company battalion for each division, with four platoons per company, is the optimum tank organization for future operations.

Such an organization gives maximum flexibility. The entire tank strength, or a considerable portion thereof, could be employed under centralized, division control to achieve the decisive striking power; when desirable, tank control could be readily decentralized. If required, each regiment could be supported by a tank company which, in turn, could be further deployed. Each battalion could be supported by one platoon—this would still leave a platoon under regimental control for exploitation or counterattack. Other combinations present themselves: weighting the attack—adding strength to local counterattacks.

This organization also affords rear area units a potent defensive weapon against marauding enemy forces which penetrate the open battle area, or carry out vertical envelopment operations to strike the weaker noncombatant service elements. Further, tanks assigned to the service elements are capable of protecting and keeping open surface routes of supply from the service area forward.

To ensure the continued strategic mobility of the division, these tank battalions are best located at force level. When combat missions are assigned, the tanks should be assigned to division or division units whenever it is physically possible to employ them.

So long as a continued need for the diversified, two-prong amphibious assault exists, and we maintain an across-the-beach capability, we must have a strong force of the most suitable tanks available. These should be organized to support effectively our concept of operations. *Tanks are not obsolete; there is no substitute.* (Italics ours. Ed.) They are capable of outstanding performance on the atomic battlefield as well as in conventional war. They contribute to warfare the principal ingredients for victory: sustained combat power and violence.

This article appeared in the October issue of the *Marine Corps Gazette* and is reprinted with the kind permission of the editor. The drawing on page 44 was the cover on the same issue of the Gazette. It was drawn by AMSgt Hobey Welsh, as artist on *Leatherneck*, another Marine publication.

By MAJOR ROBERT L. JONES, JR.

Transportation Thrift Through Central Dispatch

COMBAT commanders, in their efforts to achieve maximum unit combat capability, frequently overlook the importance of administrative type activities which, if permitted to go uncontrolled, take a surprisingly large toll of the units' effectiveness.

The large sector of responsibility assigned to the 8th Infantry Division on its arrival in Germany in 1956, resulted in wide dispersal of units. A minimum of one hour under the most favorable conditions was required to travel from Division Headquarters in Goeppingen to either Ulm or Heilbronn, and three hours from any of these locations to the forward elements at Nürnberg. Consequently, considerable distances existed between these elements and their technical service support depots.

The need for controlling and consolidating administrative traffic within the Division immediately became apparent. The staff of the supporting Transportation Battalion was given the responsibility of devising a system that would insure maximum administrative support with a minimum number of vehicles. A system termed *Central Dispatch* was put in effect on a trial basis at the Division Headquarters in Goeppingen in early 1957. The results of this trial were favorable and plans were developed to extend the system to division-wide application. This was accomplished in September 1957.

The system is under the operational control of the Staff Transportation Officer. He has one enlisted man known as the Central Dispatcher at each station where Division units are located. This Central Dispatcher receives requests from units in his area to dispatch vehicles or to move supplies and personnel These requests are received until 1500 hours of the day preceding day of dispatch, at which time the Central Dispatcher will review these requests and determine what consolidations can be made.

Common destination instructions regarding the pick-up of personnel or cargo from other units, are issued and a Central Dispatch Number is assigned. This number is the unit's authorization to dispatch a specific vehicle on a specific run. Units that will contribute cargo or personnel to the run are then given pick-up instructions by the Central Dispatcher.

Those units requesting transportation to a non-common destination will be given Central Dispatch numbers after an appraisal of the necessity has been made. Through this method, the Staff Transportation Office has knowledge of all administrative movements within the division.

In order to insure that all units are complying with the requirements of central dispatch, the Provost Marshal conducts roadside vehicle utilization spot checks. From the information provided by these spot checks, Central Dispatch personnel are able to determine which units have violated the regulations. The unit commanders or their S4s are then given the information pertaining to the violations so that they may take necessary corrective action.

The statistics for the first 18 months of division-wide Central Dispatch operation are shown in the chart.

The related savings in maintenance man-hours, spare parts, and reduced military vehicle accidents cannot be accurately priced. However, if the dollar figure on these items could be tabulated, the savings would easily double the figure.

This system, like any project that is extra-curricular in nature, required command emphasis to be successful. Subordinate commanders at first were hesitant to accept the idea as anything but another "top-side harassment." However, attitudes soon changed when they were brought closer to the problem and realized the advantages and savings that were being offered.

Administrative Miles Saved	**348,000**
Consolidations Made	**4,211**
% of Miles Saved	**13%**
Driver Hours Saved	**23,199**
Gallons of Gasoline Saved	**69,597**
$ Savings (driver hours and gasoline)	**26,000.00 Plus**

MAJOR ROBERT L. JONES, JR., Transportation Corps, is a staff transportation officer with the 8th Infantry Division, Seventh U. S. Army, Germany.

The tank crew is on trial,
but the price they will pay for any
human error will not be a lost battle.
The penalty will be merely going
safely through the routine again and
again until they can proudly call
themselves a combat crew fully trained
with what is described as the best
device of its kind yet conceived.

A New Tank Crew Trainer

IN a darkened room in a building on East Grand Boulevard, Detroit, a U. S. Marine Corps tank commander looks out from the turret of a tank to scan a wide mountain valley. He spots five enemy tanks nearly two miles away, moving in to attack.

With only seconds to spare, the turret crew of three goes into action. The commander chooses the first target. The gunner's stereoscopic range finder locates one of the enemy tanks. The loader slams a steel-piercing shell into the 90mm cannon. The shell is fired. The powerful recoil mechanism kicks back past the gunner's seat.

And out across the valley a tracer display is seen over the doomed enemy tank and a small red flash of light shows the exact spot of the shell burst. Above all is the noise of battle —the rumble of the tank engine, the gun's roar, the sputter of the 30 caliber machine gun mounted in the turret.

One element not found in actual battle is present. At a large console beside the tank sits an instructor whose electronic computer tells him instantly how the crew is doing and whether they are going to get out of their precarious position alive.

The tank crew is on trial, but the price they will pay for any human error will not be a lost battle. The penalty will be merely going safely through the routine again and again until they can proudly call themselves a combat crew fully trained with what is described as the best device of its kind yet conceived.

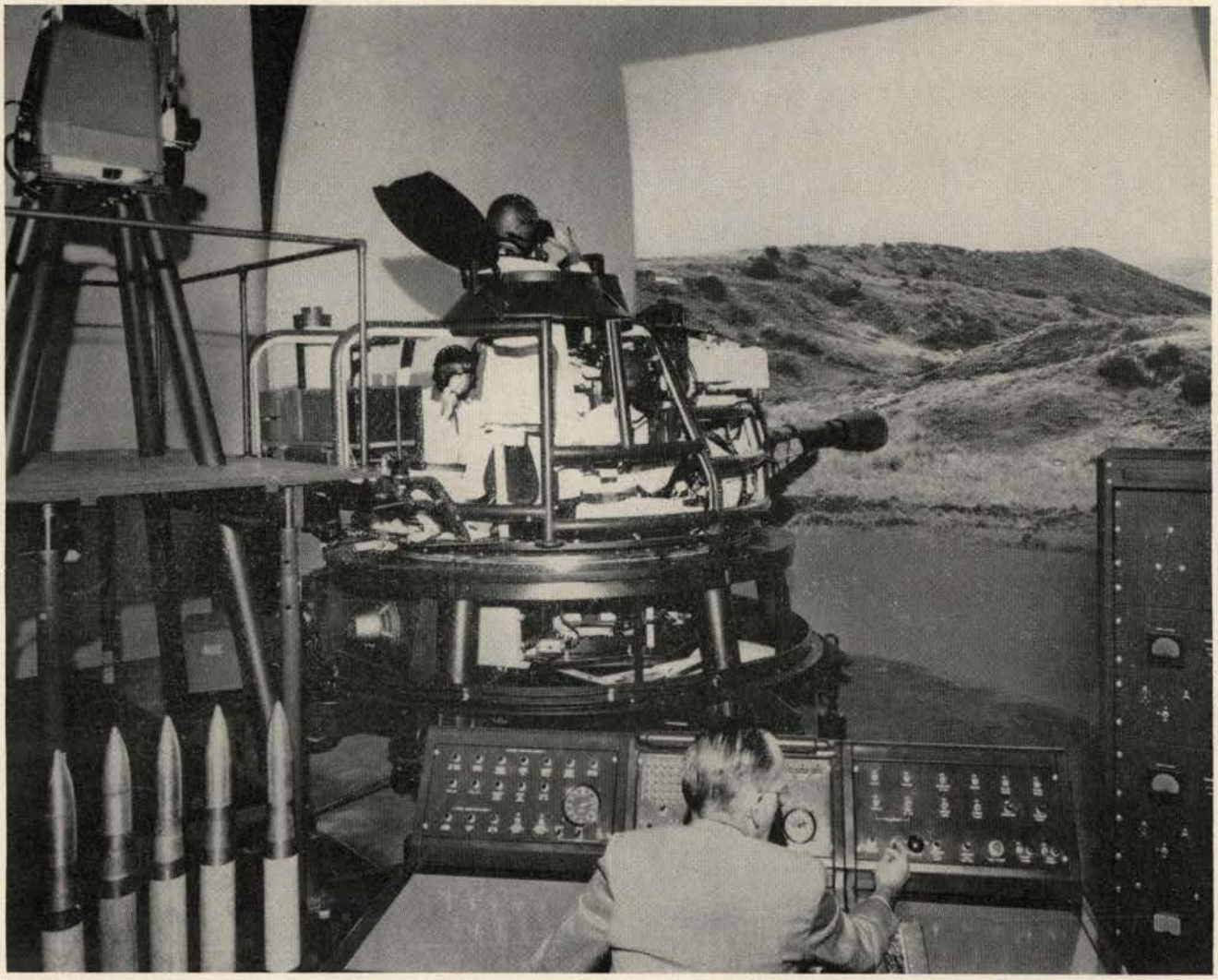
Months of work ended recently with the completion of the unique tank trainer. It was created by the engineering department of The Jam Handy Organization, 2821 East Grand Boulevard, Detroit, under the direction of the U. S. Naval Training Device Center, Port Washington, L. I.

At the successful shake down run of the device a Marine Corps spokesman said:

> When governmental economy and national security both are uppermost in the minds of the public, this new device is welcomed as a means of a tremendous saving of money while turning out trainees superbly prepared for such crises as our country might face.

As many as six shells of the actual weight and size of live ammunition can be fired each minute to give ultra-realism to operations that otherwise could be mastered only with the use of costly ammunition and fuel in gunnery practice on outdoor ranges.

The heart of the new device lies in its presentation of actual battle situations in a huge half-dome, whose inner concave face is the screen for showing photographically tank battle



(The Jam Handy Organization)

With this tank crew trainer, recruits test their efficiency in hitting enemy tanks under simulated battle conditions without going out on the range. The trainer uses an electronic "brain" to tell the instructor how the crew is doing.

maneuvers in all kinds of terrain—mountain, desert, jungle or plain.

The Marine Corps range requirement of 3,000 yards, almost two miles, called for an entirely new system of photography and optics. This is because the standard stereoscopic range finders on tanks provide three-dimensional and sharp views of distant objects. Because the range finder on the trainer must function at 12 feet (the distance to the curved screen as the cannon moves up or down or as the turret swings) the optical mechanism of the device had to be designed for this special purpose. With the problem solved, the range finder on the device operates as in tanks in the field.

In actual battle, the commander chooses targets with the help of binoculars. Because of the great magnification of distant objects on the screen when viewed with binoculars at only 12 feet, the battle maneuver scenes called for a special camera for making the training pictures on Marine Corps ranges. This camera, devised by Jam Handy technicians, has a microscopic focusing attachment for ultra-sharp definition.

The tank trainer utilizes photographic slides which are changed by remote control by the instructor, who can change battle problems within seconds as the training proceeds.

An uncanny device, an "almost human" instrument called a target tracker, is mounted on the 90mm gun. This instrument contains a supersensitive electric eye which responds to changes in light contrast. When the gunner is aiming relatively close to a specific target, the tracker records a hit on the panel of the instructor's console and feeds the information into the computer.

The brain in the console has all the known data about the targets stored in it so that it can report to the instructor on the judgment of the tank commander and gunner. It also records the number of rounds fired, the elapsed time in choosing and hitting a target, and other data on which to base the crew's efficiency score.

The tank turret in which the crew is trained is the real thing, including the weapons, except that it lacks the external steel armor of fighting tanks. The sound effects that acquaint the crew with the types of noises in a battle situation are recorded during field maneuvers.

The new device trains tank men to perform 23 specific operations within the tank and demonstrates the use of 10 individual instrument installations. Its own final tests passed with a high mark, the training tank soon will go into service at one of the Marine Corps training centers.

NEWS NOTES

Middle Ear Mechanism May Aid Men Under Gunfire

It may be possible to keep fighting men from being deafened by gunfire by taking advantage of a natural protective mechanism in the middle ear.

Experiments at the Army Medical Research Laboratory, Fort Knox, Kentucky, have shown the protective mechanism can be activated by a harmless noise sounded a split-second before a gun goes off.

The finding suggests the possibility that shells or guns, or both, might be designed to produce automatically a protective noise just before firing to give the operator built-in hearing protection.

The Fort Knox studies dealt with basic research on the middle ear protective mechanism. How protective noise might be built into shells or guns, what the noise might sound like and how it might be delivered to the operator are questions for future research.

Captain John L. Fletcher, an Army psychologist, told the Army's fifth annual Human Factors Engineering Conference meeting that the protective mechanism, called the acoustic reflex, is comparatively slow reacting to harmful sound normally.

The reflex involves the tightening of the ear drum by the contraction of two middle ear muscles. The tightened ear drum is less free to vibrate and thus less able to transmit sound vibration to the fluids of the inner ear. Captain Fletcher said it takes 9/1000ths of a second from the time harmful sound is detected and the reflex is triggered for the entire reflex cycle to be completed and the ear protected. The reflex works best against sustained sound, he reported.

Noise from a gun being fired is *impulsive,* he said, reaching a peak intensity in 2/1000ths of a second. Under ordinary circumstances, damage to hearing due to gunfire noise already is done before the reflex comes into play.

Experiments at Fort Knox have shown that protection from gunfire noise can be achieved by sounding a harmless conditioning tone 200/1000ths of a second before a gun fires and continuing it until the firing is completed.

Hearing impairment from gunfire noise can be temporary or permanent, slight or severe, depending on the individual and on the quality of the noise.

A total of 24 volunteers at Fort Knox was studied after firing a .30 caliber machine gun. An electric tone apparatus was synchronized with the gun. A speaker emitting the conditioning tone was placed near one ear of each of the men. The tone was compared to a very loud and harsh hum.

Each man fired 100 shots from the gun, hearing the reflex-activating tone starting 200/1000ths of a second before each shot. The men were given careful hearing tests immediately afterward to determine even the slightest temporary impairment of hearing.

Twenty-four hours later, when impairment due to the earlier firing had worn off, the same men fired another 100 shots, this time without the tone. Again they were given hearing tests.

Seventeen of the men did not lose as much hearing after firing with the protective tone as they did after firing without it. The difference averaged ten decibels in volume. Seven of the men got no protection. They could hear as well after firing with or without the tone. These men apparently could stand higher-than-normal impulsive noise before incurring hearing impairment, Captain Fletcher said.

All 24 said their ears felt more comfortable firing with the tone.

In another study, similar results were obtained among 15 tank crew members. In this case, the conditioning tone was synchronized with the tank guns and delivered to the men through their radio headsets.

Patents and Inventions

Inventors can now turn to a new information pamphlet just published by the U. S. Patent Office containing basic information as to patenting and patent procedures, and related information which may prove helpful in the development and marketing of their inventions. Copies are available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., at a price of 15 cents per copy.

Also available at the same price—"General Information Concerning Patents" and "General Information Concerning Trademarks."

To Retirement

(U. S. Army)

General Williston B. Palmer

Flight Navigation System

Development for the Army of a lightweight radar navigation and flight instrument system which will permit all-weather operation of aircraft and helicopters without assistance from ground-based radar and other present navigational guides, was announced recently by the Department of the Army.

The new system is being developed for the Army Signal Corps by Sperry Gyroscope Company, Hempstead, Long Island, New York. A prototype of the system, designated by the Army as AN/APN-118, was unveiled at the U. S. Army Aviation Center, Fort Rucker, Alabama.

"The lack of dependency on ground-based radio transmitters will give Army aviation freedom of movement so essential in meeting mobility requirements of the modern Army," Major General R. T. Nelson, the Army's Chief Signal Officer, stated.

A key feature of the system is a nine-inch-square map display which shows a pilot a visual picture of his aircraft's position and progress. Exact location of the plane and its direction of flight are indicated by a moving pointer against air or grid maps.

Other features of the system include an extremely accurate "free gyro" which provides accurate navigation when magnetic references become unreliable, as at the North and South poles and at extremely high altitudes; movable tape which tells a pilot his speed and rate of climb, and an auto-navigator which "remembers" flight information.

The 120-pound system weighs half that of conventional system and is far more accurate.

For Nuclear Weapon Safety

A new activity, the U. S. Army Nuclear Weapon Coordination Group, has formally set up shop at the U. S. Army

(U. S. Army)

Maj. Gen. Clayton P. Kerr
Chief, Army Division, NG Bureau

(U. S. Army)

Brig. Gen. Walter A. Jensen
United States Army Armor School

Engineer Center, Fort Belvoir.

The Group is a Class II Activity under the Office, Deputy Chief of Staff for Operations, Department of the Army, whose work will be in the field of nuclear weapon safety within the Army. It is charged with monitoring the Army weapons program from design stages through operational aspects.

Weapons-Locating Radar

Award of a contract for development for the Army of high-precision radar equipment which will locate hostile artillery sites at long range and establish a fix on their positions was announced by the Department of the Army recently.

Three models will be delivered to the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey, for tests under terms of a $15 million contract awarded to Sylvania Electric Products of Waltham, Massachusetts, for development of the radar equipment.

In operation, the radar, designated AN/MPQ-32 by the Army, will be located in forward combat areas and used in locating and destroying hostile sites. Required data is assembled and processed by high-speed computers.

The AN/MPQ-32 equipment will represent a major advance in aiding the soldier in ground combat and will contribute to the over-all effectiveness of the battlefield unit.

Nike Zeus Successfully Fired

A test model of the Army's Nike Zeus anti-missile missile performed successfully in an experimental test firing at the White Sands Missile Test Range near Albuquerque, New Mexico.

During the coasting phase, the flight terminated short of the planned trajectory, but yielded the desired technical data.

Purpose of the test flight was to obtain information on flight and propulsion characteristics of the missile.

The Nike Zeus is being developed by the U. S. Army to defend the nation against intercontinental ballistic missiles.

The Nike Zeus booster motor and sustainer motor were fired in the testing. Both performed successfully.

In a previous experimental test August 26, the Zeus test missile was launched successfully, but the flight terminated when technical difficulties developed causing a break up in mid-air.

The Nike Zeus booster, the missile's first stage, is the largest known single-engine solid propellant rocket motor ever fired. It develops more than 400,000 pounds of thrust at launch. The engine was developed by the Thiokol Chemical Company.

Grand Central Rocket Company, Redlands, California, developed the sustainer engine which will make up the second stage of the Nike Zeus.

Western Electric Company is prime contractor for the Nike Zeus.

Bell Telephone Laboratories and Douglas Aircraft Company are major development contractors.

The experimental test firing was conducted by Douglas crews.

The Army Rocket and Guided Missile Agency, a part of the Army Ordnance Missile Command at Redstone Arsenal, Huntsville, Alabama, is the Army's developing agency for the Nike Zeus program.

The booster engine previously was static fired at Redstone Arsenal. The sustainer engine included in the test was previously static fired at the Grand Central plant at Redlands.

New Power for Vehicles

A new source of electrical power—fuel cells—has come out of the laboratory to power a vehicle for the first time.

Allis-Chalmers demonstrated its fuel cell-powered tractor recently. The research vehicle develops at least 3,000 pounds of drawbar pull, enough to pull a multiple-bottom plow.

"Although our experimental fuel cell tractor is of commercial size," says Dr. H. K. Ihrig, director of research and a vice president of the company, "it still is a research vehicle.

"However, fuel cells of the future may provide electric power for homes and factories, vehicles such as trucks and buses, or even be used in military weapons or space vehicles."

The electricity that drives the tractor comes from 1,008 individual fuel cells. These are joined in 112 units of nine cells each. The 112 units are arranged in four banks and electricity can be taken from any combination of the banks.

A mixture of gases—largely propane—fuels the cells. The gases are fed into the cells through a system of tubing and, once in the cells, the gases react in an electrolyte. A catalyst coating the electrodes of each cell aids the reaction. The chemical reactions within the cells cause a direct current to flow through an external circuit which is connected by bus bar to a standard controller.

The compact controller, measuring 8 by 11 by 21 inches, regulates the electricity supplied to a standard 20-horsepower D. C. motor made at Allis-Chalmers Norwood (Ohio) Works.

The controller permits the tractor driver to regulate speed or reverse the tractor's direction by moving two levers. Using the speed control, the operator places the four banks of cells in series or parallel, varying the amount of current going to the motor.

To reverse the tractor, the driver moves the second lever, changing the polarity of the current flow to the motor.

In field tests, the tractor pulled a two-bottom plow through dry, hard ground.

The tractor carries its gas supply in tanks mounted in brackets on the vehicle.

Allis-Chalmers Research Division developed the prototype of the fuel cells used in the tractor. The company announced its fuel cell a little more than a year ago.

Since then, researchers have developed the larger, more efficient fuel cells shown today. A team of about 20 engineering scientists in the research laboratories built the larger version of the Allis-Chalmers fuel cell installed in the tractor. They also modified a standard Allis-Chalmers D-12 tractor and put the cells in it.

FROM THESE PAGES

65 Years Ago

The tactics, at any rate for the volunteer, should be of such a nature as to produce the greatest efficiency in the shortest time, while the people are filled with the enthusiasm which would induce them to submit to a great deal of drilling and discipline. By the time the enthusiasm wanes, the troops would be in such a condition as to discipline and drill that having a simple system of tactics, they should be compiled with a view to their adaptability to volunteers, not scientific military men, and should have for their object celerity of movement, not only on the battlefield, but all over the theater of war, for celerity must follow rapid fire.

It will be remembered that the soldier of Europe serves under entirely different conditions from the volunteer of America. The former is a soldier by compulsion; the latter enlists to serve his country in time of danger, because he chooses to do so. Necessarily, the tactics and discipline which govern the one will not apply to the other, therefore the volunteer soldier of America should be provided with a tactics and a discipline of his own, which, from his way of living and thinking, and from his being one of the governing class, must be very different from that which obtains in Europe—the American volunteer being a soldier from love of country, the European from compulsion.

CAPTAIN C. G. AYRES

The New Drill Regulations

50 Years Ago

It is difficult to understand how the statement that "cavalry costs three times as much as infantry" got in this text book, or how, having arrived there, it was permitted to remain.

Even in the poorly paid conscript armies of Europe, with the high prices of horses and of forage which reign there, it is doubtful if this statement is approximately true.

Is it possible that this phrase has come down to us from the Middle Ages when the infantry were "a ragged rabble" and cavalry "knights in armor."

If so, let it be relegated back to the Dark Ages, where it belongs.

* * *

Here in these United States of America in the year of 1909, in this age of progress, we have especial need of a large force of cavalry; first, because in time of war cavalry cannot be improvised; secondly, because in case of war on this continent great masses of cavalry would be indispensable; and, thirdly, because our cavalry on foot, is man for man equal to infantry; and mounted, has a mobility which infantry can never rival. If for this mobility we pay thirty percent more, it is worth it.

COLONEL JAMES PARKER

The Relative Cost of Cavalry and Infantry

25 Years Ago

. . . A French lieutenant stepped out of one tank and informed me, in excellent English, that the four tanks were at my disposal. If he had presented me with four pink elephants I could not have been at a greater loss as to their proper use. I asked him if he could knock out the 77's across the ravine and he replied that although he had been shot out of two tanks during the morning he would try it if I said so.

* * *

. . . Then as we were walking along with this tank, to the right of the hill where the company was halted, we could see some men trying to pass through the Missy ravine and were being mowed down by machine-gun fire, fired by two machine guns which were set up and concealed in a dugout made in solid rock at the edge of this hill and in an opening for direct fire through part of the ravine. Everyone was able to see how this gun was mowing down our troops. The French lieutenant commanded his tank to the place where this machine gun was and opened fire with at least a dozen shells directly into the dugout entrance. The company remained still at the top of the hill edge while the tank was firing. I remember that after the tank crew had put the machine gun out of action the accompanying platoon moved forward through the ravine, and there were three tanks there in all. The tanks stopped and opened their doors and the crews came out to greet us.

MAJOR LEONARD R. BOYD

Will It Happen Again?

10 Years Ago

There were few spectators last April 15 as the big plane roared down the runway at the Fort Worth Division of Consolidated Vultee Aircraft Corporation. After all, the flight was a part of the regular testing program. The handful of onlookers, however, saw aviation history made as the wheels left the runway and the plane took off over Lake Worth on a three-hour test flight.

The XC-99 military transport was carrying 100,000 pounds of simulated cargo—heaviest load ever taken aloft in one airplane. The air carriage of a cargo load almost double anything previously known was no longer just an item of a flight test program. It was now an accomplished fact.

To the commanders of airborne divisions, or to anyone interested in making entire armies airborne, the military implications of the above flight are obvious. Here, for the first time, was an airplane heavy enough and roomy enough to haul many of the largest pieces of Army equipment, including armored vehicles.

And now that the two tank battalions formerly attached to an airborne division have been made an integral part of it, the need for developing large transports capable of carrying medium tanks and other heavy armored vehicles has become even more urgent.

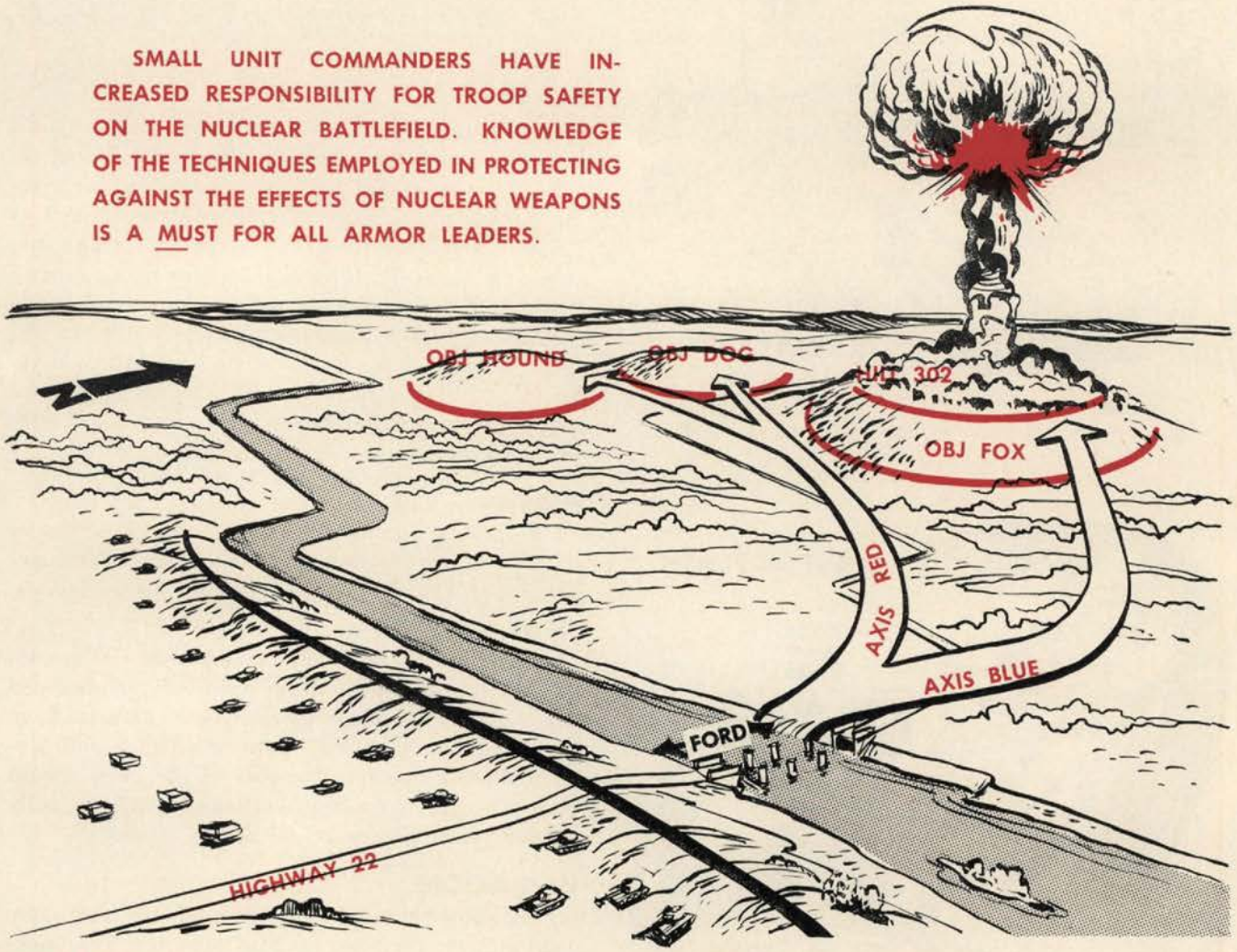
J. W. LARSON

The Transport of Armored Vehicles

How Would You do it?

US ARMY ARMOR SCHOOL PRESENTATION

SMALL UNIT COMMANDERS HAVE INCREASED RESPONSIBILITY FOR TROOP SAFETY ON THE NUCLEAR BATTLEFIELD. KNOWLEDGE OF THE TECHNIQUES EMPLOYED IN PROTECTING AGAINST THE EFFECTS OF NUCLEAR WEAPONS IS A MUST FOR ALL ARMOR LEADERS.



FIRST SITUATION

You are commander of Team A, Task Force 1/1, consisting of a tank company and an attached armored rifle platoon. Team A has the mission of attacking north across a defended river line to seize Hill 302 (see above).

A 2-KT nuclear weapon will be detonated on enemy positions defending the selected crossing site (ford). Team A is the leading team and will cross the river immediately after the nuclear preparation and attack along axis Blue to seize objective Fox. The balance of the task force will follow Team A across the river and attack along axis Red to seize objectives Hound and Dog. The wind is from the south at 12 miles an hour.

REQUIREMENTS

(1) What individual and unit protective measures would your team take to protect against the effects of the nuclear detonation?

(2) What procedures would you use to warn your troops about the impending burst?

(3) What are your responsibilities in reporting this and other nuclear detonations observed?

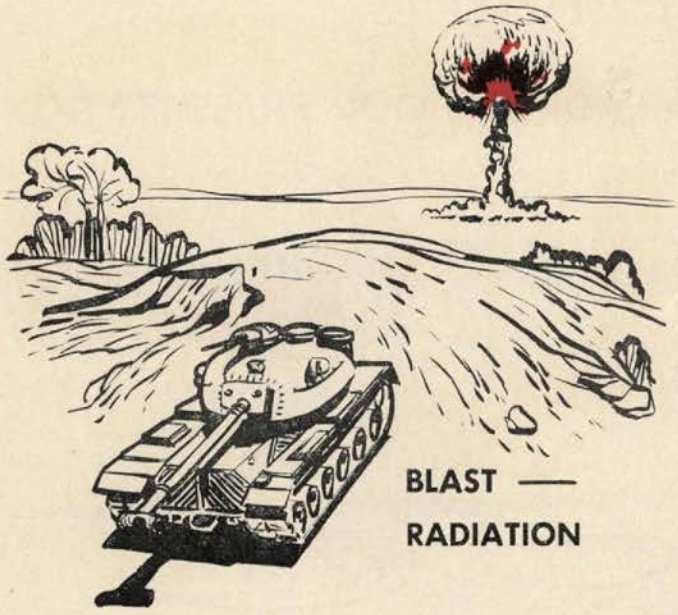
(4) What measures should be taken to monitor the burst area for residual radiation prior to or during operations in the area?

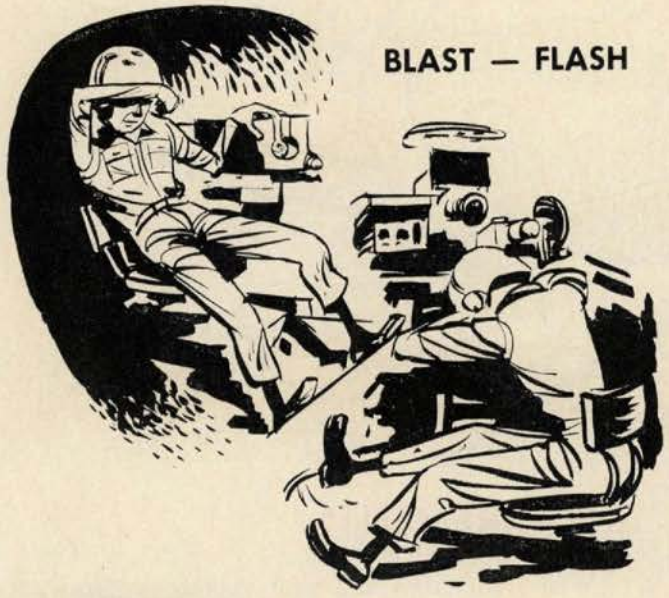
AUTHOR: LT COL F D BUSH

ILLUSTRATION: MR J H BAIN

ARMOR—November-December, 1959

Solution





(1) PROTECTIVE MEASURES

The following protective measures should be taken against the effects of a planned friendly nuclear detonation:

BLAST

Personnel remain in armored vehicles with all hatches closed and locked. (Personnel riding in wheeled vehicles and armored vehicles without overhead cover must dismount and seek cover, such as foxholes, ditches, ravines, or permanent man-made structures that offer protection against flying debris.) Individuals wear tank or steel helmets and brace themselves against sudden movement caused by the blast. Secure ammunition and equipment inside vehicles. Position vehicles in defilade, facing toward blast, but with turret facing away from blast with turret traversing mechanism locked.

FLASH

To protect against flash blindness, all personnel shield their eyes at moment of detonation. Personnel in tanks or APC's do *not* look through vision devices.

HEAT

Oily rags or other inflammable material are removed from the exterior of vehicles. Dismounted personnel should place themselves in defilade from the explosion. Anything casting a shadow will provide some protection. No part of the body should be exposed unnecessarily; personnel should be fully dressed, with sleeves rolled down.

RADIATION

The same shelters that protect against blast offer good protection against nuclear radiation. The thickness and density of the material between personnel and the burst determine the amount of radiation one will receive. The steel plates of the tank are particularly effective in reducing the intensity of the radiation, and the armor protection of other vehicles offers protection depending upon the thickness of the armor. Seven and one-half inches of earth, four and one-half inches of concrete, or one and one-half inches of steel will reduce radiation intensity by 50 percent.

(2) WARNING PROCEDURES

In order to have time to accomplish the protective measures described above, troops must be warned of the impending detonation. Unit SOP's should include a secure system for alerting troops by radio, pyrotechnics, or other means just prior to the time of detonation.

• • • FIRST SITUATION AND REQUIREMENTS

③ REPORTING RESPONSIBILITIES

Unit commanders must report *all* nuclear explosions they observe on the battlefield. Unit SOP's should prescribe a simple, secure reporting procedure. The following information should be included in reports:

Type of burst—air, surface or subsurface.

Azimuth—observer to burst.

Location of observer.

Range—observer to burst.

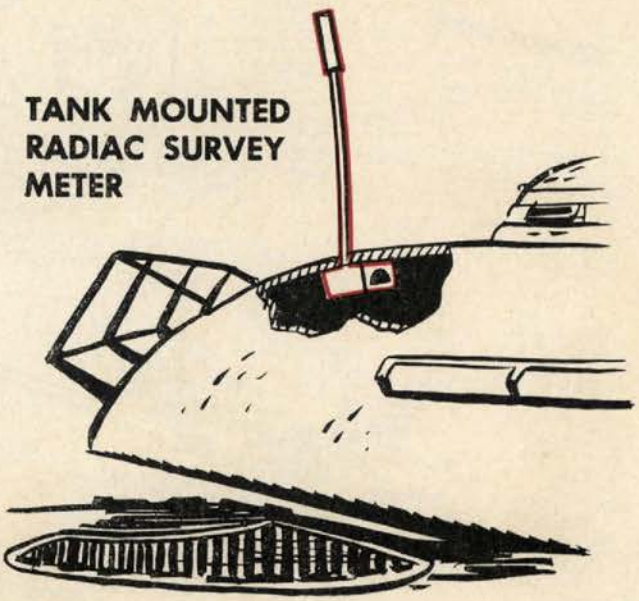
REPORTING RESPONSIBILITIES

④ RESIDUAL RADIATION DETECTION MEASURES— MONITORING & SURVEYING

When proceeding into or through an area that has been subjected to a nuclear detonation, you must check residual radiation. Special detection instruments are used for this purpose.

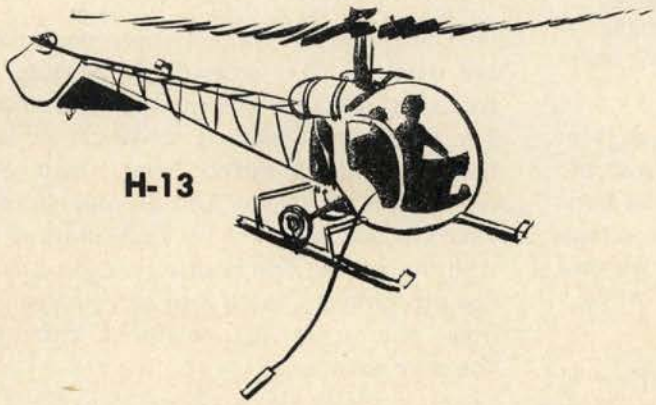
The dose rate meter, IM 108/PD, of which Team A has six (the armored rifle platoon has one and the tank company, five), can be likened to an automobile speedometer which indicates, instead of speed, the intensity of nuclear radiation being received at a particular moment. Dosimeter, IM 93/UD (eight per tank company and one in the armor rifle platoon), is similar to an automobile odometer and measures the total nuclear radiation which has been received.

In this situation, the task force commander would probably dispatch one of his supporting Army aircraft to survey the area prior to crossing it. In addition, you would use your own dose rate meters to monitor the radiation in your vicinity, both before and during your attack. Dosimeters should be checked from time to time while in the affected area to ensure that individual doses received do not exceed the maximum permitted in the unit SOP.



TANK MOUNTED RADIAC SURVEY METER

IM 93 DOSIMETER

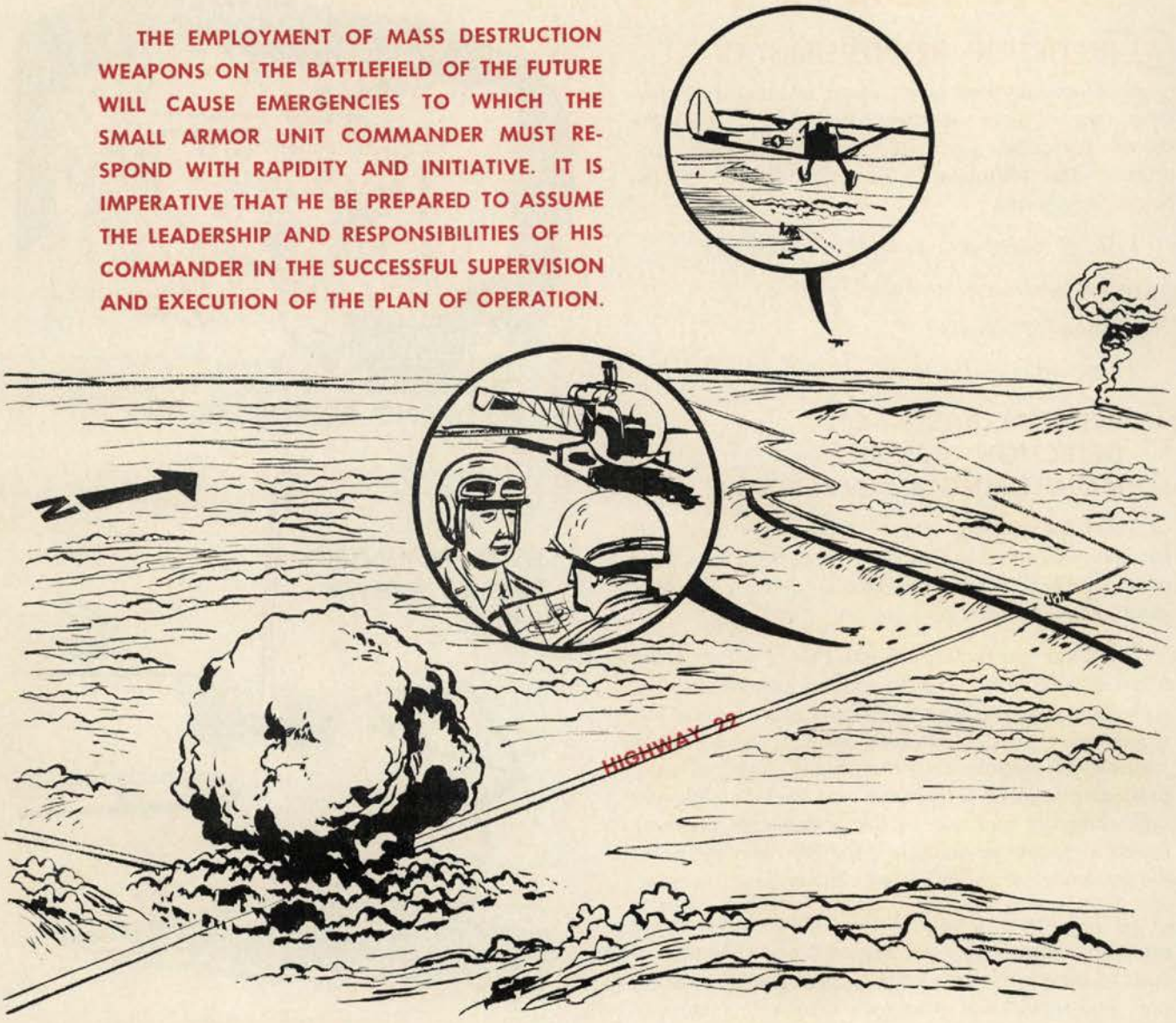


H-13

CONTINUED

HOW WOULD YOU DO IT? . . . . CONTINUED

THE EMPLOYMENT OF MASS DESTRUCTION WEAPONS ON THE BATTLEFIELD OF THE FUTURE WILL CAUSE EMERGENCIES TO WHICH THE SMALL ARMOR UNIT COMMANDER MUST RESPOND WITH RAPIDITY AND INITIATIVE. IT IS IMPERATIVE THAT HE BE PREPARED TO ASSUME THE LEADERSHIP AND RESPONSIBILITIES OF HIS COMMANDER IN THE SUCCESSFUL SUPERVISION AND EXECUTION OF THE PLAN OF OPERATION.



SECOND SITUATION

It is now H-5 minutes. Your nuclear preparation was detonated at H-15 minutes. The helicopter which surveyed the burst area lands at your position and reports the results. Considering the high attenuation rate of armored vehicles, radiation in the objective area appears to be within acceptable limits for operations by your team.

As you are discussing the extent of damage in the area with the pilot, you monitor a call from the task force fixed-wing Army aircraft which has been reconnoitering to the north. He reports that a column of 35 enemy tanks and personnel carriers is moving south along Highway 22, ten miles north of your objective area.

As you start to call the commanding officer of your task force to advise him of your readiness to cross the stream and occupy the objective, you are startled by a flash and then a nuclear explosion to your rear. Looking back, you observe a black double-headed mushroom cloud rising in the sky at a distance that you estimate to be 5 miles.

Your efforts to contact your commanding officer are fruitless. You receive no response even after trying other radio equipment. It is now H-hour. You realize your team is in danger of fallout from the enemy nuclear surface burst, which will probably require you to move. You are out of contact with your CO and have not yet been ordered to proceed with the attack. You realize that something must be done to protect your troops and prevent the enemy from reinforcing his shattered defenses in the objective area.

How would you do it?

Solution . . . . . SECOND SITUATION

In this situation your duty is clear—you must take action to continue the mission. However, you must continue your efforts to contact your next higher headquarters concurrently. You might instruct your forward observer to try to establish contact through fire support channels. You might also request the Army aircraft to fly to the rear and investigate the condition of task force headquarters. You would attempt to enter the combat command command net to report the situation and get instructions.

If you cannot contact a higher commander, you should contact the commanding officers of the other teams to ascertain if they are ready to proceed. If you are the senior company commander in the task force, you would assume command of the task force and order the mission executed according to plan. The situation requires positive action. The movement of your team across the stream and the subsequent assault and occupation of your assigned objective in order to prevent the enemy from reinforcing this position comprise the most logical course of action open to you at this time. Circumstances beyond your control prevented your obtaining guidance from higher headquarters concerning predicted fallout data, which additionally justifies your decision. Furthermore, the safest place on the nuclear battlefield may well be within the enemy's position.

CONCLUSIONS

Decisions on nuclear battlefield must be rapid and all-encompassing.

Lacking guidance from above, a small unit commander must act to best accomplish the overall mission.

Communication procedures must be flexible enough to allow for all contingencies. SOI extracts for team commanders should include call words and frequencies of adjacent units, the combat command, as well as the area signal center.

Unit SOP's should provide for a succession of leadership in case of emergencies.

Although great armor leaders of the past mastered many difficult situations, the nuclear battlefield will present a challenge to armor commanders of the future that dwarfs the imagination and will be unprecedented in the annals of warfare. Are you prepared to accept this challenge?

THE BOOK SECTION

Command Decisions

The value of this book resides in the fact that it is a study of decision-making on the highest levels. Its themes are military. But the military decisions had far-reaching effect upon civil and political life, and at the same time mirror the way in which many civil and political decisions are made. It is a book for the thoughtful soldier.

COMMAND DECISIONS. Prepared by the Office of the Chief of Military History, Department of the Army. 481 pp. Harcourt, Brace & Company, New York City, New York. $5.95.

Reviewed by Walter Millis

PRIMARILY, no doubt, this is a book for military men. But it has much more than a purely military significance, and I suspect that it will interest even the soldier as much in his capacity as a citizen of the free society as in his capacity as a military professional. It is not only that many of these wartime decisions had far-reaching political consequences, and were often, indeed, determined by the political heads of the states. In civil life no less than in war—in modern big politics, big industry, big labor—the "command decision" is a phenomenon of increasing importance, about the mechanics of which we know too little.

THE REVIEWER

Walter Millis, a 1920 Yale graduate, is a well-known military author and analyst. He served as editorial staff writer for military affairs on the *New York Herald Tribune* from 1924-54. Previously he held similar positions on the *Baltimore News* and *New York Sun and Globe*. He is author of *The Martial Spirit; The Road to War; Why Europe Fights; The Forrestal Diaries*, for which he served as editor; and *Arms and Men*. He is the co-author of *Arms and the State* which was reviewed in the September-October issue of *ARMOR*. He lives in Glen Head, New York.

If a man empties his purse into his head, no one can take it away from him. An investment in knowledge always pays the best interest.

Benjamin Franklin

In all these areas the processes are much the same. Industry or labor or politics have their intelligence appreciations, their staff planning, their logistical estimates, their inner conflicts of strategic concept, these ultimately resolved, as in war, in high level consultation from which "command decisions"—often of the greatest public importance—emerge without the public having had any part in the process. In the decisions of war the tensions and the drama are immeasurably heightened, the results more immediately apparent, the record usually more complete and more accessible to subsequent historical analysis. The command decisions of war thus offer a singularly fruitful field for study, but it is the study of a modern policy-making process which has much more than purely military implications.

The 20 decisions examined in this volume were of widely different character, and were developed in different ways out of differing situations. They range from such broad and basic strategic decisions as that which led the United States from the beginning to place the defeat of Germany ahead of the defeat of Japan, down to sudden battlefield decisions—really tactical in character—such as that which led MacArthur to drop the planned defense of Luzon in favor of the retreat into the Bataan position. There are decisions, like that to retreat to the Elbe, primarily political in effect, which were yet made on strictly military grounds; there is the decision to use the atomic bomb, of profound military consequences, which was made by the civilian President largely on civilian advice and for political reasons, and almost without reference to the current strategic planning. There is Hitler's decision to invade Norway which, far from developing out of long-range strategic plan, was taken almost as a "side-show," mounted only because time and opportunity served.

Feature Reviews Exclusive with **ARMOR**

Some of these decisions seem in retrospect to have been "right" within their terms; others seem probably to have been "wrong," but some of the more interesting are those, like Roosevelt's decision for North Africa in 1942, about which the issue can never be decided. There were sound and compelling reasons on both sides of the argument; there was no real way of weighting the one set against the other, and there is no way of even guessing how events would have turned out had the decision been for the opposite course.

The problems raised by these decisions are so various that adequate review would really require not one article but 20; since that is out of the question, one can search only for certain general factors which in one way or another they appear to illustrate. One is the appalling irrealism of much peace-time war planning. American war planners in the inter-war years were concentrating on a bi-lateral Japanese-American war long after it should have been apparent that such a conflict could occur only in a larger, global context; while down to the late '30's they were still considering (at least as a theoretical exercise) a two-front war in which the United States would have to fight Britain and Japan in alliance! Only rather belatedly did the logic of events force them to face the real problem: a simultaneous threat from the Axis on the Atlantic side and the Japanese

(Official Coast Guard Photo)

The U. S. from the beginning placed defeat of Germany ahead of defeat of Japan.

on the Pacific. Ironically, the theoretical studies of a "Red-Orange" war (they had pointed to a defensive in the Pacific with the major effort against Britain in the Atlantic) helped the planners to get over their preoccupation with Japan, and so accept the Atlantic first policy in alliance with the British. But this decision to put Germany first was dictated less by any profound strategic analysis than by the simple nature of the situation; and when the then Chief of Naval Operations, Admiral Harold R. Stark, first clearly stated the policy that was to rule throughout the war (in a memorandum of November 1940) it was accepted almost as a statement of the obvious.

The Japanese decision for war in 1941 is a study in irrealism of a somewhat different kind. The immediate war plans were (as we learned to our heavy cost) sound enough; the expectation that, once the new empire had been seized, it could be held until the United States and her allies had tired of the attempt to retake it was mistaken, but not unrealistic. The final argument for war, however, was the argument that if Japan did not strike then she would be rendered incapable of striking at all. She would be reduced to seeking her national ends thereafter by those peaceful means which Secretary Hull tried to make inviting to her. One could hardly expect the militarists who were in power to prefer peaceful to warlike means; but it was precisely in their expectations of what could be accomplished by war that they were unrealistic.

The Japanese militarists knew that they were taking big risks, but their estimation of the true odds was imperfect. According to General Tojo, the risk had to be taken "in order to tide over the present crisis for self-existence and *self-defense*." He could not understand that the two terms were not synonymous. The author adds that "Tojo and his supporters" felt that Japan was "doomed if it did not meet the challenge." Japan "had no alternative but to go to war while she still had the power to do so. She might lose, but defeat was better than humiliation and submission." Defeat ensued and entailed both humiliation and submission; but neither destroyed Japanese "existence," and it can be argued that the doom to which her militarists sentenced her was much worse than any she would have met had she accepted peaceful ways of meeting a "challenge" which was never a challenge to anything except her military domination. The hard-bitten warriors are often the greatest romantics of all, following a fantasy which the modern world is emptying of all rational content.

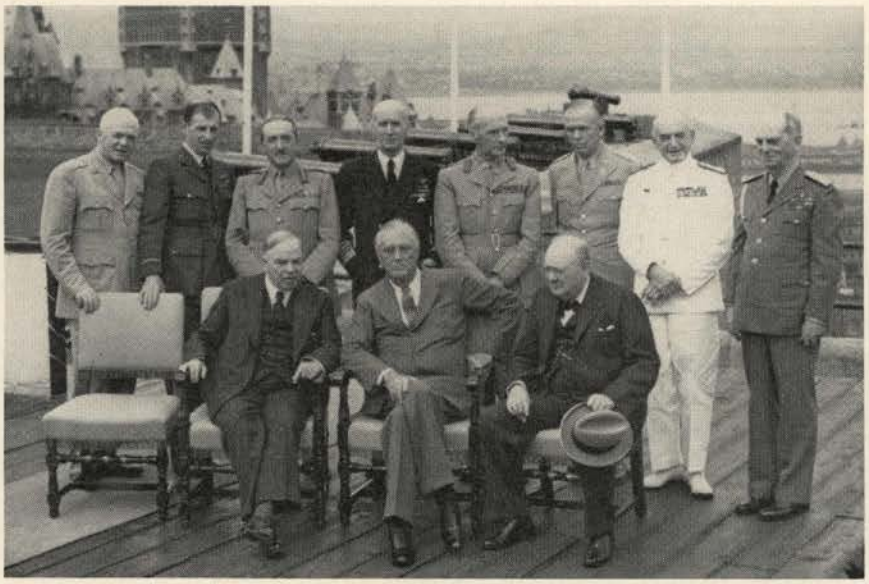
Under actual combat conditions this want of realism in the planning is much less pronounced. The goals are simpler—merely to "win" a given campaign—the relevant factors of strengths, terrain and logistics are more concrete, and sometimes, as after the sweep through Northern France in 1944, impose their own solutions, to which the strategist can do hardly more than append his initials. But decision is still bedevilled by the difficulty of getting realistic planning alternatives between which to decide. The planners are likely to expect too much, or too little, or make both mistakes, and an executive like Major General John P. Lucas at Anzio is likely to fall between, fumble it and be relieved, to spend the rest of his life contemplating the skill with which the planners, high and low, put on him all the blame for results which the planners themselves helped to ensure.

Another rather general factor of interest is the way in which the decision comes to rest, so to speak, on a long process of argument, often internal rivalry, conflicting views, the combat of fiercely held ambitions, working up only slowly to the top levels, where at last the decision may be determined more by the underlying ferment than by the external requirements. For some vital decisions (again one may cite MacArthur's withdrawal into Bataan) there is no time for this; things happen, and crisis has to be met immediately. Other decisions (particularly those which flowed from Hitler's "intuition") may simply be imposed from the top against all argument and staff advice. But both these cases appear to be exceptions rather than the rule. Roosevelt, Churchill and the top military commanders appear more often as arbitrators, simply giving their casting votes in issues long and bitterly disputed on lower levels, not infrequently for reasons only distantly related to victory.

The unsuccessful air drop at Arnhem was motivated as much by a desire to find a strategy which would employ the airborne troops as by a strategic need for which airborne troops were the best answer. "The paratroopers and glidermen" of the First Airborne Army, training unused in England, "had in effect become coins burning holes in SHAEF's pocket." Bradley wouldn't have them in 12th Army Group, believing that their airlift could be much better employed re-supplying the ground. But General H. H. Arnold, commanding the Army Air Force, had repeatedly "voiced his desire for an airborne

(U. S. Army)

An LCI burns while troops and equipment come ashore at the Anzio beachhead.



(U. S. Army)

Roosevelt, Churchill and their military advisers were able to rise above argument to adopt and enforce policies which produced the common end of victory.

operation that would have strategic implications." "Monty's" plan for an airborne strike to secure the lower Rhine met "Hap" Arnold's specifications. Not a bad idea in itself (it came very close to success), it was hurried to action for reasons which some of those "coins" in SHAEF's pocket, especially the ones who were expended, might have thought a little odd.

Even the big decisions involved factors of international or interservice politics not strictly strategic in character. Admiral Stark's 1940 memorandum proposing the Germany first policy contained a suspicious note: "Never absent from British minds are their postwar interests, commercial and military. We should likewise safeguard our own eventual interests." The note persisted. The two major differences between American and British strategists—over going into North Africa in 1942 and between an invasion of Southern France or a strike for the Ljubljana Gap in 1944—were fought out over weeks and months, with each side more and more distrustful of the other's purposes, with the strategic and logistic arguments tending more and more to become the "good" reasons for courses which each side thought had "real" or ulterior reasons behind them. The suspicions and arguments remain to this day. It is to the undying credit of Roosevelt, Churchill and their ablest military advisers that they were able to rise above the argument and to adopt and enforce policies which, whether or not they were the "best" under the circumstances, were largely shaped by the circumstances and did produce the common end of victory.

A third common factor is the irrevocability of the decision, once taken. The commander, and the planners on whom he relies, must try to estimate the outcome, but will never be able to do it perfectly. The commander must decide for a course of action with no clear knowledge of the consequences, but aware that the consequences will be irreversible. When Hitler staked everything on the Battle of the Bulge, his military advisers told him that the chances of success were small. They wanted him to reduce the operation to more limited and more attainable objectives. Hitler refused, probably rightly within his own terms. No limited success could have freed him from the defeat already virtually inevitable. If his tankers could drive to the Meuse and to Antwerp, the war could have ended differently. Anything short of that would at most prolong for a few weeks or months a war he had already lost. He shot his bolt in the Ardennes in December 1944; the stroke was turned, Hitler lost his last reserves, and there was nothing before him but suicide in the bomb-shattered ruins of the Reich Chancellery, which had been built to last "a thousand years." But that would have been the end in any event, and the decision to gamble on the Ardennes offensive was probably the best that he could have made under the conditions surrounding him, although it irrevocably decided the outcome of the war.

(U. S. Army)

Hitler shot his bolt in the Ardennes—he lost. With his reserves lost there was nothing before him but suicide in the bombshattered ruins of Berlin.

The value of this book resides in the fact that it is a study—and I think unique in this—of decision-making on the highest levels. Its themes are military. But the military decisions had far-reaching effect upon civil and political life, and at the same time mirror the way in which many civil and political decisions are made. It is a book for the thoughtful soldier. Even more, I think, it is a book for the thoughtful civilian.

Armor Magazine Index — Vol. LXVIII, 1959

TITLES

	No.	Page
Achilles' Heel—A Soldier's Eyes, Robert W. Forsyth and John P. Forsyth	5	16
Airlanded Armored Infantry, Major Rolfe L. Hillman, Jr.	1	6
Ally In Gray, Lieutenant Colonel John W. Hopkins, Jr.	6	20
Amphibious Tanks, Eberhard Johannis—Translator: Captain Norbert Brandon	1	42
Antitank Guided Missile *vs.* Armor, Captain Paul M. Crosby	6	9
Antitank Missiles For Armored Infantry, Lieutenant Colonel John D. Webber, Jr., Major Clifford D. Rhodes, Captain Robert W. Thams and Captain Norman D. DeBord	5	65
ARMOR ASSOCIATION:		
Annual Report of the Secretary-Treasurer-Editor	2	14
The Seventieth Annual Meeting of the United States Armor Association	4	4
Report on the Annual Meeting by the Secretary	4	6
Message from the President of the United States	4	9
The Keynote Address	4	10
Strategic Aspects of Firepower, Mobility and Shock Action—Today and Tomorrow	4	15
Some Thoughts on Armor of the Future	4	19
Armor Mobility—A Challenge to Industry	4	25
Army Missiles and Space Technology	4	28
The New Council	4	31
Salutes From Around the World	4	32
Association Award	4	49
Armor Leadership Award, 1958, Lieutenant Colonel Robert J. Bennett	2	31
Army Training Test—Howitzer Batteries, Armored Cavalry Regiment, Lieutenant Colonel Gordon E. McQuain	5	60
Artillery In A Rocad Division, Brigadier General William F. Ryan	2	4
Assisting the Foreign Student, Lieutenant Colonel Herschel H. Hutsinpiller	5	70
BOOK REVIEWS:		
Lost Victories, Colonel Leo J. Meyer, Ret.	1	58
Armor Command, Brigadier General Sidney R. Hinds, Ret.	2	58
Nuclear Tactics, Weapons, and Firepower In the Pentomic Division, Battle Group, and Company, Lieutenant Colonel Robert B. Rigg	2	59
The Tanks: 1914-1945, Colonel Robert J. Icks, USAR, Retired	3	60
Swamp Fox: The Life and Campaigns of General Francis Marion, Jac Weller	4	60
A Guide to Anti-Communist Action, Colonel James N. Peale, Jr.	4	62
Arms and the State, George Fielding Eliot	5	76
Command Decisions, Walter Millis	6	58
Chariots—The First Combat Vehicles, Richard M. Ogorkiewicz	2	17
Chief of Staff, United States Army	4	40
Combat Leadership, Major Charles W. Dryer	1	39
Delay and Defense Course	1	51
EDITORIALS: No. 1, p. 4; No. 2, p. 22; No. 3, p. 14; No. 4, p. 46; No. 5, p. 8	6	14
Education and the Soldier	3	48
Field Modifications: GI Ingenuity in Action, Private First Class Paul Counsell	5	62
Fighting Helicopters?—Yes, Lieutenant Colonel Albert E. Seifert	5	58
FROM THESE PAGES: No. 1, p. 57; No. 2, p. 57; No. 3, p. 59; No. 4, p. 56; No. 5, p. 64	6	52
Gasoline Economy For Armor, Howard C. Olson	2	44
HOW WOULD YOU DO IT? (A U. S. Army Armor School Presentation) No. 1, p. 55; No. 2, p. 55; No. 3, p. 57; No. 4, p. 57; No. 5, p. 73	6	53
Improved Land Navigation	1	50
Improving Our Capabilities for Limited War, General Maxwell D. Taylor	1	22
Independent Command, Jac Weller	5	22
Individual, Squad, Section and Platoon Testing, Captain John C. Faith	6	34
Is the Sea Mistress Feasible? Major John C. Burney, Jr.	3	40
Let's Make the Tank Crew Pentomic, Captain Norbert Brandon	3	16
LETTERS TO THE EDITOR: No. 1, p. 2; No. 2, p. 2; No. 3, p. 2; No. 4, p. 2; No. 5, p. 2	6	2
Logistical Training, Captain Edward L. Waggener	3	50
M113 Armored Personnel Carrier	3	8
M60 Medium Tank	2	12
Machine Gun Training: A Neglected Subject, First Lieutenant Richard M. Meyer	3	37
Military Diesels, Major General Nelson M. Lynde, Jr.	5	10
Mortar and Navigation, Second Lieutenant James W. Owen	6	42
New Equipment: Displayed at the AUSA Meeting	5	56
New Tank Crew Trainer	6	48
NEWS NOTES: No. 1, p. 52; No. 2, p. 52; No. 3, p. 54; No. 4, p. 54; No. 5, p. 68	6	50
Objectives for Armor of the Future, General Bruce C. Clarke	4	34
Paper Tiger or Integrated Deterrence? Second Lieutenant Thomas E. Carpenter, III	5	25
Pictorial History of Armor, Lieutenant Colonel Robert B. Rigg	5	42
Powerful, Highly Mobile Tank Still Army Objective, Mark S. Watson	6	19
Q—Star, Major Donn A. Starry and Captain Vernon A. Quarstein	3	18
Rapid Reconnaissance, Now! Major Harry H. Hiestand	1	46
Realism in a Combat Firing Course, Andrew J. Eckles III and Lieutenant Colonel Curry N. Vaughan	1	12

	No.	Page
Reconnaissance Platoon Leader, Colonel William E. Potts	4	48
RECONNOITERING: No. 1, p. 24; No. 2, p. 42	5	54
Reorganization of the Department of Defense, Lieutenant Colonel Ace L. Waters, Jr. and Lieutenant Colonel Jack A. Rogers	1	17
Revision of the Armored Cavalry Regiment, Colonel John A. Beall, Jr.	3	5
Revisions to ROCAD, Colonel John A. Beall, Jr.	2	48
ROTC Armor Cadets, 1959	4	53
Saving in Maintenance Time	3	52
2d Armored Division Tanks at Battle of Alamein, Lieutenant General Willis D. Crittenberger, Ret.	4	50
Seen at the 41st Meeting of the American Ordnance Association: A Pictorial Feature	6	32
Self-propelled Artillery Development	6	30
Soviet Tank Superiority? Captain John D. Henderson and Captain Ernest Kassner	6	16
Standard Emergency Task Force, Colonel John K. Boles, Jr. and Lieutenant Colonel Jacob R. Degenhardt	6	39
Steps in the Right Direction, Captain Richard E. O'Brien	1	26
STRAC, Colonel Vernon R. Rawie	3	43
Swedish Armor, Lieutenant Colonel Mirco P. G. Rolf	6	4
Tank Armament, Richard M. Ogorkiewicz	6	25
Tank Commander Training in the Reserve Components, Dr. Robert A. Baker	4	37
Tank Gunnery Qualification Course, Captains Thomas G. Foster, III and John M. Pickarts	5	28
Tanks? Major W. C. Barrett	6	44
Toward Better Armor Training Management, Dr. Robert A. Baker	2	24
Training An Army National Guard Armored Division, Major General Clayton P. Kerr	2	35
Transportation Thrift Through Central Dispatch, Major Robert L. Jones, Jr.	6	47
Twenty Years Ago—Armor in the 1939 Polish Campaign, Richard M. Ogorkiewicz	5	4
United States Military Academy Class of 1959 Armor Graduates	4	52
Victory Before Dawn, Marvin Parrott	4	42
Which Method? First Lieutenant William C. Haponski	3	10
"Why Not Divarmor?" Lieutenant Colonel Francis J. Kelly	5	18

AUTHORS

	No.	Page
Baker, Dr. Robert A. ..... No. 2, p. 24	4	37
Barrett, Maj. W. C.	6	44
Beall, Col. John A., Jr. ..... No. 2, p. 48	3	5
Bennett, Lt. Col. Robert J.	2	31
Boles, Col. John K., Jr.	6	39
Brandon, Capt. Norbert (Translator) No. 3, p. 16	1	42
Burney, Maj. John C., Jr.	3	40
Carpenter, 2d Lt. Thomas E. III	5	25
Clarke, Gen. Bruce C.	4	34
Counsell, Pfc. Paul	5	62
Crittenberger, Lt. Gen. Willis D., Ret.	4	50
Crosby, Capt. Paul M.	6	9
DeBord, Capt. Norman D.	5	65
Degenhardt, Lt. Col. Jacob R.	6	39
Dryer, Maj. Charles W.	1	39
Eckles, Andrew J. III	1	12
Eliot, George Fielding	5	76
Faith, Capt. John C.	6	34
Forsyth, John P.	5	16
Forsyth, Robert W.	5	16
Foster, Capt. Thomas G. III	5	28
Haponski, 1st Lt. William C.	3	10
Henderson, Capt. John D.	6	16
Hiestand, Maj. Harry H.	1	46
Hillman, Maj. Rolfe L., Jr.	1	6
Hinds, Brig. Gen. Sidney R.	2	58
Hopkins, Lt. Col. John W., Jr.	6	20
Hutsinpiller, Lt. Col. Herschel H.	5	70
Icks, Col. Robert J.	3	60
Johannis, Eberhard	1	42
Jones, Maj. Robert L., Jr.	6	47
Kassner, Capt. Ernest	6	16
Kelly, Lt. Col. Francis J.	5	18
Kerr, Maj. Gen. Clayton P.	2	35
Lynde, Maj. Gen. Nelson M., Jr.	5	10
McQuain, Lt. Col. Gordon E.	5	60
Meyer, 1st Lt. Richard M.	3	37
Meyer, Col. Leo J.	1	58
Millis, Walter	6	58
O'Brien, Capt. Richard E.	1	26
Ogorkiewicz, Richard M. No. 2, p. 17; No. 5, p. 4	6	25
Olson, Howard C.	2	44
Owen, 2d Lt. James W.	6	42
Parrott, Marvin	4	42
Peale, Col. James N., Jr.	4	62
Pickarts, Capt. John M.	5	28
Potts, Col. William E.	4	48
Quarstein, Capt. Vernon A.	3	18
Rawie, Col. Vernon R.	3	43
Rhodes, Maj. Clifford D.	5	65
Rigg, Lt. Col. Robert B. ..... No. 2, p. 59	5	42
Rogers, Lt. Col. Jack A.	1	17
Rolf, Lt. Col. Mirco P. G.	6	4
Ryan, Brig. Gen. William F.	2	4
Seifert, Lt. Col. Albert E.	5	58
Starry, Maj. Donn A.	3	18
Taylor, Gen. Maxwell D.	1	22
Thams, Capt. Robert W.	5	65
Vaughan, Lt. Col. Curry N.	1	12
Waggener, Capt. Edward L.	3	50
Waters, Lt. Col. Ace L., Jr.	1	17
Watson, Mark S.	6	19
Webber, Lt. Col. John D., Jr.	5	65
Weller, Jac ..... No. 4, p. 60	5	22

The United States Armor Association

Recommends this book for your reading pleasure

Sylvanus Thayer of West Point

Although the Military Academy at West Point was founded by Congress 15 years before Sylvanus Thayer became its Superintendent, it was not until he took command that any real claim could be made for it as a school for the military training of officers. He was the first of his era to insist upon both scientific and military preparedness, and his visionary genius assured future generations of a professional officer corps and trained engineers. In the 16 years of his devoted administration, the Military Academy grew from a badly conducted rudimentary school to become the first military school in the United States operated under military discipline, teaching military and natural sciences, as well as those arts essential for the mental training and educational equipment of an officer.

Time has proved Sylvanus Thayer to have been a master builder. Almost all the principles, policies and methods of chief importance established by him have endured for more than 125 years to remain the vital substance of West Point today.

By GEORGE FIELDING ELIOT **$2.95**

PLEASE KEEP US INFORMED OF YOUR CORRECT ADDRESS

ORDER FORM BOOKS BINDERS — *Armor*
1757 K Street, N.W., Washington 6, D. C.

Please send me the following:

_____

_____

_____

_____

_____

_____

NAME (Please Print)

ADDRESS (Street or Box Number)

CITY (Town or APO)

STATE

☐ I enclose $.....

☐ Bill me. (Members only.)

☐ Bill unit fund.

BATTLE:

The Story of the Bulge

By John Toland **$5.00**

At 5:00 A.M. on December 16, 1944, 1,900 pieces of heavy German artillery suddenly bombarded the peaceful Ardennes front. Soon after the bombardment 250,000 Germans and almost 1,000 tanks and assault guns smashed into what was regarded by the supremely confident Allies as a rest area; the so-called "Ghost Front" was defended only by exhausted or green United States troops.

Hitler had launched his final and most surprising offensive. It was his greatest gamble. It was a plan so audacious and fantastic that not a single Allied commander guessed it was coming. In fact, many refused to believe it for several days.

The Battle of the Bulge was the greatest pitched battle ever fought by Americans, and their only major struggle in the dead of winter. Before it was over they had suffered 80,000 casualties.

The story of the Bulge is told here in its entirety, and completely from the point of view of individuals on both sides—from American and German officers and enlisted men, to citizens and saboteurs. As often happens in war, incidents of mass surrender and massacre occur side by side with moments of comic opera or unusual heroism.

The Bulge was an unorthodox battle. Lines either did not exist or were bewilderingly fluid. Communications were unreliable—men fought in isolated groups (many who were there will discover what really happened for the first time while reading this book). Surrounded Americans were only a few miles away from surrounded Germans. But in this kind of fight the American GI—whose independence and cockiness made him a poor garrison soldier—came into his own.

Lincoln Finds a General

Vol. V: Prelude to Chattanooga

By Kenneth P. Williams **$7.50**

This fifth and last volume of *Lincoln Finds a General* includes the defense of Helena by Prentiss, the capture of Port Hudson by Banks, Sherman's capture of Little Rock, John Schofield's ordeal in the troubled department of Missouri. Then in Chapter VII the scene shifts to Rosecrans's headquarters at Murfreesboro and returns to January 1863, immediately after the battle of that name. Step by step the reader is shown the delays, the continued pressure from Washington, and the skillful maneuvers by which, in June, Rosecrans advanced through the mountain gaps in pursuit of his determined adversary, a pursuit which ended in disaster for him at the Battle of Chickamauga on September 20, 1863. The volume ends with Grant in October 1863, about to start to restore the situation on the Cumberland.

VOLUME I AND II, published in 1949, describe the military fortunes of the Union in the East under a succession of commanders, from Fort Sumter to Gettysburg in July 1863.

VOLUME III, published in 1952, is an account of the first year of the war in the West, the Battle of Shiloh, the capture of Corinth and the effort to take Vicksburg.

VOLUME IV, published in 1956, covers the period of the campaigns in the West from mid-July 1862 to Grant's capture of Vicksburg on July 4, 1863.

Mobility
Firepower
Shock Action

WITHIN YOUR MAGAZINE . . .

The M113
Armored Personnel Carrier

THE M113 ARMORED PERSONNEL CARRIER

ARMOR—May-June, 1959

In today's highly mechanized army, with its new weapons, greater firepower and mobility, and an ever increasing tempo of warfare, it is essential that Armor personnel keep abreast of the latest developments in the field of mobile warfare.

The spread of the M113 APC (above) is from a recent issue of *ARMOR*. It is typical of the up-to-date information that appears in every issue. Whether you are a Regular, Reservist, or Guardsman, this information is available to you through the pages of . . .

ARMOR

The Magazine of Mobile Warfare